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NEW ZEALAND JOURNAL OF Agriculture

JUNE - 1952

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FARM BULLETIN published by COOPER, McDOUGALL & ROBERTSON (N.Z.) LTD.
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No. 24 PUBLISHED EVERY SECOND MONTH June, 1952

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This Month's Cover

Agriculture

Part of Tokanui Hospital farm, near the main Te Awamutu-Otorohanga highway and 5 miles from Te Awamutu, is the subject of this month's cover, which has been reproduced from a colour photograph by National Publicity Studios. The farm has 840 acres devoted to grazing and cropping. A milking herd of between 90 and 100 cows supplies the hospital's needs and a surplus is sent to a dairy factory. The farm has modern piggeries in which about 40 breeding sows are kept and a model slaughterhouse which provides the hospital with about 240 carcasses of beef, 600 to 700 of mutton, and 100 of pork a year. Excellent plantations of trees for wind breaks and shelter are a feature of the farm.

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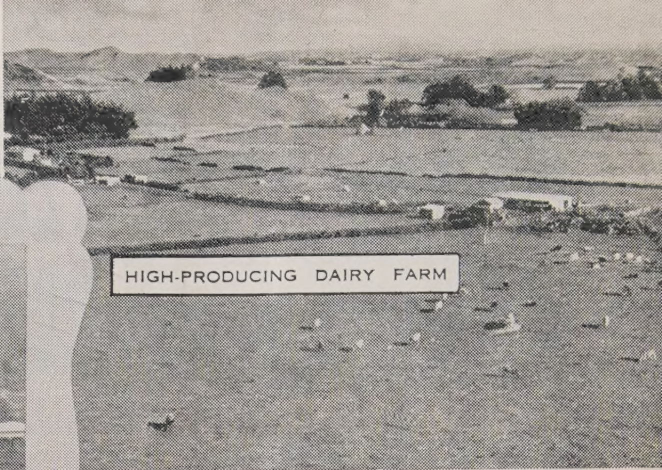
THE DAIRY INDUSTRY



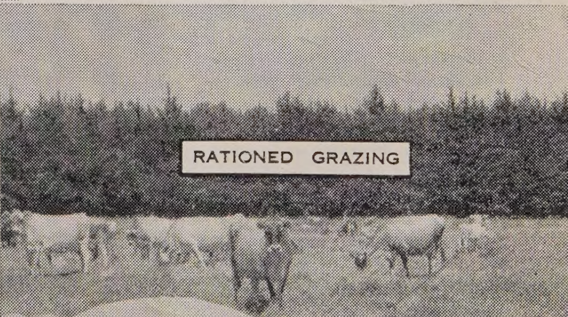
HIGH-PRODUCING DAIRY FARM

CLEARED BUSH COUNTRY, 1905-1910

The history of the development of the dairy industry in New Zealand to its present proportions is one of remarkable progress, occupying considerably less than a century. In 1884-85 about 123 tons of butter and 823 tons of cheese were produced in factories, and in the 1950-51 season the total production of butter was about 178,600 tons and cheese 108,500 tons. The advance on the farm and in the manufacturing dairy has been consistent and the standard high in both fields.

[Photographs by National Publicity Studios and from the Alexander Turnbull Library photographic collection.

EARLY MILKING SHED



RATIONED GRAZING

MACHINE MILKING

GREYTOWN FACTORY

TOKO, EARLY 1900's

Prospects of Record Dairy Production

THERE are very good prospects for another record in butterfat production for the dairying season which will end on 31 July. Although much of the weather during spring was not encouraging to some other types of farming, and was notable for wind, the conditions suited dairying. Rainfall was adequate in the main dairying districts, and although the frequent showers during the haymaking season caused dairy farmers many worries, they were conducive to good pasture growth, which to New Zealand is essential for the production of milk. Overall the climate this season has not been ideal for dairying, but good rains have always arrived when conditions were becoming a little dry for pasture growth.

Rise in Dairy Cow Population

Accurate statistics of the number of cows in milk this season are not available at the moment, but the steady increase in the Dominion's cow population is encouraging. This increase has been maintained despite the attractive prices for produce from other types of farming in recent years. Naturally there are reductions in some areas, but Northland, South Auckland, Bay of Plenty, and Taranaki are all showing healthy increases due to better farm husbandry, the breaking in of new land, and the rehabilitation of ex-servicemen. Apart from the fact that much of our land is more suitable for dairying than other forms of agriculture, the record of stability of returns for dairy produce plus the fact that the farmer receives a cheque each month of the year tend to make dairying attractive to so many who are on the land.

Improvement in Milking Machines and Technique

Science has done much to help the dairy farmer. Improved milking machines and a scientific approach to the technique of machine milking have been important factors in removing the drudgery which years ago was inevitably associated with the twice-daily task of milking cows.

The modern New Zealand milking shed, with its simplicity of design and the comparative ease with which it can be maintained in a sanitary condition, has been evolved as a result of the experience of our own dairy farmers. What a difference there is between our present-day open shed and the dark, depressing structures we had 30 or 40 years ago.

Reduction of Herd Wastage

Much of the improvement in butterfat production in recent years is due to the reduction in herd wastage. Herd wastage was always costly to the farmer and costly to the country too. Science has helped to reduce the losses from sterility, abortion, and, perhaps in greatest degree, through the use of penicillin in mastitis control. The work of herd improvement operated by the New Zealand Dairy Board has been a valuable contribution to greater production. The percentage of cows on test increases each year and is now 25 per cent. The benefits of the Herd Improvement Plan are available to all dairy farmers, whether they are testing their herds or not, through the data available from sire survey work. But farmers are urged in their own, as well as in the national, interest to make use of herd-testing facilities and the fund of information which is available for their use.

Better Pasture Species Developed

I stated earlier that good pasture growth was essential to dairy production, and that statement is worth repeating. Here the scientist has made probably the greatest contribution to the dairy farmer. Not only has the scientist developed the most suitable and nutritious types of grasses and clovers, but he has found the ways in which the pastures can be used most effectively. This knowledge if availed of to a greater extent could have a most significant effect on our dairy production. When one sees what is done by some farmers through the use of the best strains of grasses and clovers and good pasture management one can easily visualise the immense potential production from our soil and climate.

Dairy farmers are to be congratulated on their efforts despite the labour difficulties which the war and post-war conditions have imposed. It is easy to criticise and exhort, but we must all remember that the dairy farmer has many practical difficulties and problems.

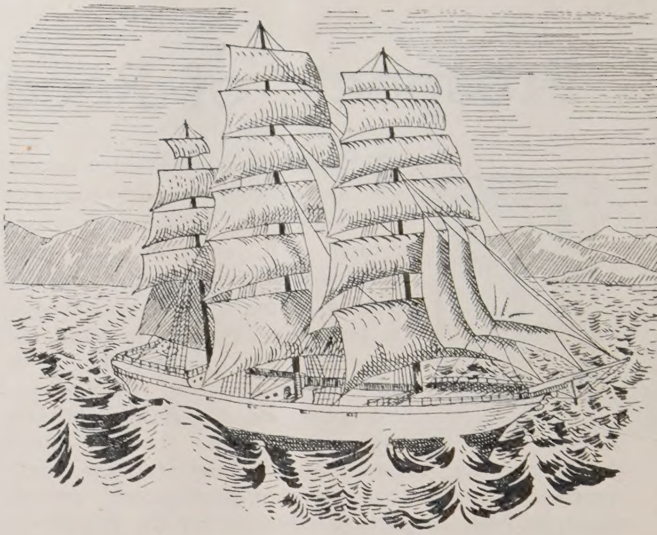
The dairy industry of New Zealand has a proud record of achievement. It is outstanding in efficiency, and, unlike dairying in some other countries, it is a specialised industry. The dairy farmer has displayed his individuality in many ways, not the least of which is the manner in which co-operative control and ownership of the dairy factories have been developed. Almost all of New Zealand's dairy factories are owned by the farmers who supply the milk and cream to them. Through the New Zealand Dairy Board the dairy industry manages its own affairs and imposes its own discipline. Through the Dairy Products Marketing Commission it has a share in the marketing of dairy produce.

The dairy industry is progressive in its outlook. A watchful eye is kept on the necessity to cater for world markets and to take advantage of opportunities. There are likely to be great developments in the manufacture of dairy products apart from the staple products, butter and cheese. These ventures will require good judgment balanced with initiative and enthusiasm, and I feel sure our dairy industry will continue to expand and to play an increasingly important part in the economy of our country.

K. J. HOLYOAKE, Minister of Agriculture

Protecting New Zealand Livestock against Importation of Disease

By A. G. BRASH, Veterinarian, Department of Agriculture, Christchurch



OUTBREAKS of foot and mouth disease in overseas countries serve as a reminder that only at the price of constant vigilance are this and other stock diseases kept from New Zealand's shores. Steps taken to prevent the introduction of such diseases by immigrants emphasise that quarantine has many ramifications apart from control over the importation of animals. With increasingly fast transport between countries, control of animal disease has rapidly become a world problem. New Zealand's shield is the quarantine regulations administered by the Department of Agriculture, backed by a veterinary service and a farming community fully awake to the danger that is always present. As it is not impossible that despite every care a serious stock disease may gain entry to the country, early reporting of all suspicious cases by farmers is of vital importance.

QUARANTINE regulations are sometimes a source of irritation to the public, particularly when their application appears to have no direct relation to stock diseases. People sometimes let private interests and their desire to import animals from certain countries obscure the over-all aim of disease control. Administration of measures to prevent the introduction of serious animal diseases is an important function of the Department of Agriculture and a responsibility that is not taken lightly. In this activity the interests of the individual must be subsidiary to those of the primary producers as a whole and to the protection of New Zealand's all-important livestock industry.

Lessons from the Past

Up to the present New Zealand has been remarkably free from serious animal plagues and the few outbreaks that have occurred have been dealt with in a manner that reflects great credit on past administrators. During the early years of colonisation animal plagues were rife throughout the older countries of the world, yet only two major epidemic diseases were introduced, pleuro-pneumonia of cattle in 1864 and sheep scab earlier. No doubt the time taken to transport stock to New Zealand had an important bearing on this. Swine fever was present in New Zealand on two occasions later and was eradicated each time.

In the eradication of diseases that did gain entry to the country two factors stand out as having been of primary importance—the introduction of effective legislation and the willingness of farmers to follow the veterinary advice of the day. The eradication of pleuro-pneumonia from New Zealand, where on the advice of a veterinary surgeon a policy of slaughtering infected animals was enforced, is in striking contrast to the situation in Australia, where similar advice was not followed.

First Legislation 90 Years Ago

The first New Zealand legislation dealing with disease control was the Diseases of Cattle Act 1861. This was followed by the Diseased Sheep Act 1878, the purpose of which was the eradication of sheep scab. The effectiveness of this pioneer legislation is proved by the fact that it achieved its purpose within 7 years. Sheep scab is still the cause of much economic loss in many countries, so its early eradication from both New Zealand and Australia must be regarded as a very worthy achievement.

In 1893 the Stock Act was introduced and in 1894 the importance of veterinary control was recognised by the appointment of Dr. J. A. Gilruth as Chief Veterinary Surgeon. Dr. Gilruth left a legacy of effective disease control, the benefits of which are felt to this day. Amendments to the original Act were consolidated in the Stock Act 1908; since then further amendments have been made as they were found necessary, and the whole Act is now being revised.

Purpose of Quarantine

The purpose of the quarantine regulations is to provide adequate protection against the introduction of disease without restricting unnecessarily the importation of stock when this can be permitted safely. Regulations dealing with importations other than those of stock are intended

Quarantine Regulations must be Backed by Informed Opinion

to interfere with the normal trade of the country as little as possible. Regulations for which there is no adequate basis cause unnecessary losses to both agricultural and commercial interests.

One advantage of having adequate restrictions is that other countries will more readily permit imports of stock from New Zealand when they know that the Dominion's regulations allow them to do so with complete safety.

Obviously, for an informed opinion to be reached about what stock may be admitted and from what countries, an accurate and up-to-date knowledge of stock diseases in other countries is essential. To supply this information a clearing house in Paris provides monthly bulletins. Participating countries are immediately notified of extraordinary outbreaks of disease in any part of the world.

Regulations Affecting Animals

The importation of stock from all countries is prohibited without a permit from the Minister of Agriculture or, for animals not classed as stock under the Stock Act, from the Minister of Internal Affairs. Such permits are only granted for certain countries, for example, United Kingdom and Australia, and under conditions either laid down by Stock Act Regulations or by the Minister of Internal Affairs for importations other than farm stock. All imported stock must be accompanied by a declaration of freedom from disease from the owner and a certificate of health signed by an official veterinarian in the country of origin. The importation of stock by air is prohibited.

On arrival all stock are inspected at the port of entry by a Government Veterinarian, who issues a "permit to land" only when satisfied that they are in good health and that the necessary papers are in order. Depending on the country of origin, the animals may then go to their owner without further inspection, they may be subject to isolation and inspection on the owner's premises for a period, or they may go for a period of quarantine under supervision to either of the quarantine stations at Somes Island, Wellington, and Motutapu, Auckland.

The embargo on direct importation of cattle, sheep, pigs, and goats from Great Britain was lifted in 1947 after having been enforced since 1924. The conditions under which stock are imported from Great Britain made lifting the ban perfectly safe. Before leaving England stock must be admitted for at least a fortnight to the Liverpool or London Quarantine Stations controlled by the Minister of Agriculture and Fisheries. Animals are admitted to the stations only after searching inquiry has established that the district of origin is free from disease. They are kept at the stations under the strictest conditions of quarantine, with adequate laboratory facilities for making tests, and are then taken directly to the ship. On arrival in New Zealand they undergo a further 30 days of quarantine.

Australian stock which are allowed into New Zealand include dogs, horses, pigs, and sheep, except from Northern Territory, Queensland, and part of Western Australia. Cattle are admitted only from Tasmania.

Dogs are prohibited from all countries in which rabies is present. Poultry are prohibited from all countries, but hatching eggs are allowed in from Australia. As the situation changes from time to time, no detailed summary of the restrictions will be given. People wishing to import animals should obtain information from the Department of Agriculture.

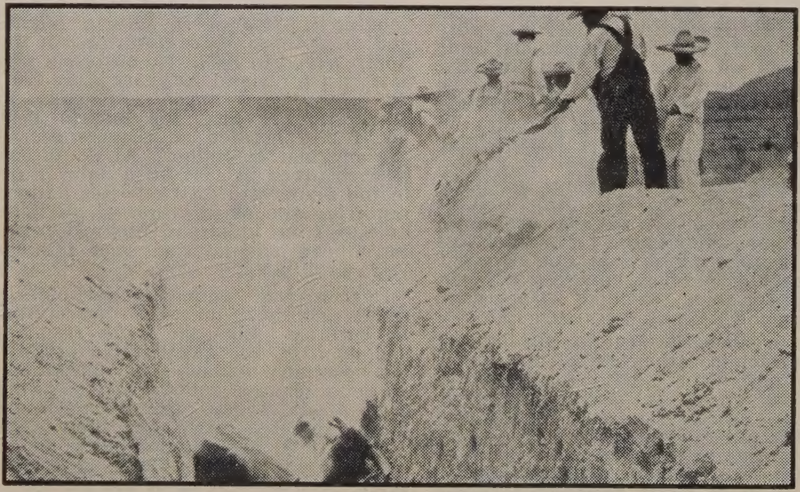
Regulations Affecting Other Imports

The danger of introduction of diseases by means other than the live animal is often very great. For example, the foot and mouth disease virus may be carried on clothing and footwear or in straw packing, the swine fever virus may be present in garbage, and anthrax and tetanus may be carried on used sacks.

Therefore a close check must be kept on anything that could possibly introduce disease. Straw packing must have a certificate of sterilisation or be destroyed, used sacks are allowed from only certain countries and must be disinfected, and the introduction of ships' garbage is prohibited. The recent arrival of immigrants by air from countries where foot and mouth disease is prevalent has made necessary the issue of special instructions dealing with the disinfection of clothing, footwear, and other articles.

The Scourge of Foot and Mouth Disease

PHOTOGRAPHS reproduced on this and the opposite pages illustrate the lengths to which a country whose livestock is afflicted with foot and mouth disease must go in defence of its animal industry. Taken in Mexico, they show the disinfecting of corral walls after the removal of infected animals and the spreading of quicklime on a great trench of diseased carcasses preparatory to their being buried. Almost all cloven-footed animals, especially cattle, pigs, sheep, and goats, are susceptible to foot and mouth disease, and for no other disease are such prompt and energetic measures necessary to check its spread. New Zealand's shield against such devastating infections is its quarantine regulations.



To assist farmers in the early detection and reporting of outbreaks brief descriptions of some of the more serious animal diseases follow. Symptoms resembling those of some of these diseases may be caused in individual animals by diseases already present in New Zealand, but when a number of animals are affected on the same farm investigation by a qualified veterinarian becomes especially urgent. Public understanding and co-operation are essential for the prompt suppression of possible outbreaks.

Foot and Mouth Disease

The possible introduction of foot and mouth disease is of special significance for two reasons: It is distributed very widely overseas, and recently numerous outbreaks in Europe and the eastern counties of England have been followed by its spread to Canada, where it was presumably taken by a passenger travelling by air from Europe. The virus may live for many months and the administration of quarantine safeguards is complicated by the possibility of infection being introduced through numerous avenues other than by living animals. Fortunately, New Zealand's food requirements do not call for the importation of meat from countries where the disease is endemic. Ordinary refrigeration does not destroy the virus but preserves its infectivity. The importation of meat no doubt is responsible for many of the outbreaks in England.

Almost all cloven-footed animals, especially cattle, pigs, sheep, and goats, are susceptible to foot and mouth disease. Horses are immune. The incubation period most usually is from 48 to 72 hours, but may be up to 10 days or even longer after infection. The average is 3 to 6 days. The disease is characterised by the formation of vesicles or blisters on the lips, mouth, and tongue, on the skin between and above the claws of the feet, on the bulbs of the heels, and on the teats and udder. In cattle any one or several of these locations may be involved. In pigs vesicles frequently occur also on the snout. The muzzles of cattle are only rarely affected. In sheep and goats the feet are the most common site of vesicle formation. The blisters usually burst within 24 hours, leaving a raw surface. The temperature rises markedly in the early stages, the animals being dull and off their feed, but the first symptoms to attract attention may be the sudden appearance of lameness, slavering from the mouth, or both. In pigs especially the foot lesions may cause the claws to be shed.

During the attack animals lose condition, and in cows the milk yield is reduced severely. The deterioration of the animals may cause far greater loss than deaths, which may not exceed 5 per cent. There is, however, a rarer, malignant form to which 50 per cent. of infected animals may succumb.

The virus is present in the fluid of the vesicles, saliva, milk, and other secretions. The period for which it survives varies in different circumstances, but it can live for several months under ordinary field conditions. It can readily be spread on clothing, footwear, implements, or other infected objects. It is fairly resistant to some ordinary disinfectants, but is readily killed by a 5 per cent. solution of washing soda or a 1 to 2 per cent. solution of caustic soda.

Foot and mouth disease is extremely infectious and for no other disease are such prompt and energetic measures necessary if spread is to be stopped. For eradication of the disease isolation of the infected premises and slaughter of the livestock are necessary.

Rinderpest

The ancient virus disease of cattle plague, rinderpest is less of a menace to New Zealand than is foot and mouth disease. It is less widely distributed and is now confined to certain localities in Europe and Asia. It does not spread as rapidly as foot and mouth disease and the virus persists for a shorter period outside the animal body.

The incubation period is from 3 to 9 days, or in exceptional cases up to 17 days. The most prominent symptoms are high fever, red spots becoming greyish necrotic ulcers (not preceded by blisters) inside the mouth and nose, a discharge from the mouth and nose, and diarrhoea which may be blood stained. Lameness and foot lesions are absent. The mortality is very high and may exceed 75 per cent.

Contagious Pleuro-pneumonia

A disease of cattle, contagious pleuro-pneumonia was introduced into the South Island in 1864 but was eradicated. It now occurs mainly in Africa, Asia, Australia, and parts of Europe, not including Great Britain. Symptoms are those of pleurisy and pneumonia, that is, rise in temperature, coughing, and distressed breathing.

The disease is spread by droplet infection and there is little danger of its spread except by contact with an infected animal. It does not seem to persist on vacated premises.

This disease presents peculiar difficulties of control because of the prolonged incubation period (29 to 58 days or even longer) and the fact that cattle may carry the infection for long periods without showing symptoms. Therefore importation of cattle from infected countries must be prohibited.

Anthrax

Introduced into New Zealand in bone manure from India and Australia, the first cases of anthrax occurred in Auckland Province. From 1900 to 1907 outbreaks were reported from widely separated parts of the North Island, and an outbreak was confirmed in the South Island in 1903. No outbreak was recorded for about 20 years after 1907. Of later years three outbreaks in Auckland Province, the last in 1950, could be regarded as recurrences of the original infection. An outbreak also occurred in 1944 on a dairy farm in the Manawatu district. Regulations requiring the sterilisation of all bone manure from India and Australia were introduced, and later all such imports were prohibited.

Herbivorous animals, particularly cattle and sheep, are most susceptible to anthrax. Pigs are more resistant and poultry are practically immune, but human beings are susceptible. Anthrax causes sudden deaths from septicaemia, sheep often being found dead. Infected cattle may show dullness and a high temperature for a short period before death, and pigs often have a swelling of the throat.

Anthrax spores are extremely resistant and may persist in the soil or in old bones for at least 50 years. Animals suspected to have died of anthrax should not be opened up, as exposure to the air causes the formation of the resistant spores in the anthrax bacillus. The disease is controlled satisfactorily on infected farms by vaccination.

Swine Fever

Another virus disease that presents formidable difficulties to quarantine control, swine fever is fairly widely distributed in America (where it is called hog cholera), almost all European countries, Africa, and Asia. The presence of the disease in New Zealand was recorded by Dr. Gilruth between 1895 and 1902. Since then there has been only one outbreak, which occurred in 1933 in garbage-fed pigs near Wellington; the disease was eradicated in less than 2 months after the slaughter of nearly 2000 pigs on 13 farms.

In countries where swine fever is prevalent the virus may be present in the meat of pigs slaughtered when apparently healthy and which passed the ordinary meat inspection. As the virus may live for at least 3 months in pickled or salted pork or ham, the danger of garbage feeding is obvious. In New Zealand not only the introduction of garbage from overseas ships but also the entry of all uncooked meats is prohibited. England's large imports of pig meats are responsible for many of the outbreaks in that country. Internal control in New Zealand makes it compulsory for all pig feeders using garbage to have a licence from the Department of Agriculture, and all garbage fed must be cooked.

Like foot and mouth disease, swine fever is extremely contagious. The incubation period is usually 5 to 7 days, but may be longer. Mortality in susceptible pigs is high and may reach 80 to 90 per cent. The fact that the acute forms of some pig diseases already present in New Zealand may cause heavy mortalities makes the reporting of all pig losses very important. The symptoms may resemble those of swine fever. In the 1933 outbreak several unreported centres of infection were located.

The onset of the disease is sudden, causing loss of appetite, fever, weakness, a red rash at the base of the tail, under the abdomen, under the thighs, and on the ears, and a gummy discharge from the eyes. The disease can be diagnosed certainly only by blood-transmission tests carried out at a laboratory.

Rabies

The virus disease of rabies, which is usually transmitted to man or to other animals by the bite of an infected dog, is distributed widely overseas. It is prevalent in North and South America, Asia, and parts of Europe, not including Great Britain. No case of rabies has ever been seen in Australia or New Zealand.

The disease attacks the brain and spinal cord with fatal results. Control is made more difficult by the long incubation period, which is usually from 2 weeks to 3 months, though isolated cases have occurred in England after release of dogs from 6 months' quarantine. The prohibition of the importation of dogs from countries where rabies is present must therefore be enforced rigidly. Sentiment for dogs or any other animals cannot be allowed to interfere with the operation of the regulations.

Equine Encephalomyelitis

The virus disease which causes sleeping sickness in horses and human beings, equine encephalomyelitis is widely distributed in the United States. Since 1930, when the disease was first reported, more than a million horses and mules have been affected. Average mortality is commonly about 25 per cent. of animals affected and has been as high as 58 per cent. in 1947. Vaccination gives only partial control. During outbreaks in America a number of human cases are usually reported. The disease is generally believed to be transmitted by blood-sucking insects. When artificially injected the virus is capable of infecting more species of animals than perhaps any other known virus. During severe outbreaks 10 per cent. or more of the horses and mules in an area may be affected.

The importation of horses from the United States and Canada was prohibited in 1939.

Infectious Anaemia

Infectious anaemia or swamp fever has long been known as a specific disease of horses, mules, and donkeys. Reported from Europe as early as 1843, it now occurs in various parts of Europe, Asia, Africa, and South America and is widely distributed in the United States. The cause is a virus which can be transmitted by contact between animals, by infected feed or water, and by the bites of insects. The incubation period may vary from less than a week to 3 months or longer, and infected horses may carry the virus for life.

The disease may occur in an acute, rapidly fatal form, or more commonly as a chronic affection with intermittent fever, loss of weight, and progressive weakness. No satisfactory treatment is known.

The difficulty of diagnosis and the period for which the virus may persist in the blood of apparently healthy animals make this disease difficult to control.

Glanders

A serious disease of horses, glanders may also infect human beings. It is not nearly as widely distributed as formerly and has been eradicated from many countries. Fortunately, a reliable diagnosis can be made by the use of the mallein test, and with the normal quarantine control the disease is unlikely to gain entry to New Zealand.

[*National Publicity Studios photo.*

In some of New Zealand's more difficult country the handling of stock without the services of dogs would be almost impossible. It would be a sad day for the farmers of the Dominion if the dread canine disease of rabies, which is widely distributed overseas, appeared in this country. That is why the prohibition of the importation of dogs from countries where the disease is present must be enforced rigidly.

Poultry Diseases

The now widespread distribution throughout other parts of the world of the virus diseases of the fowl pest group (Newcastle disease and fowl plague) is a great menace to the poultry industry in New Zealand. The total prohibition on the importation of poultry, eggs (except hatching eggs from Australia), and birds, especially game birds, is therefore very wise. In view of the incidence of poultry diseases in countries overseas, New Zealand's comparative freedom from such infections should be closely guarded.

Newcastle Disease (Fowl Pest)

First diagnosed at Newcastle-on-Tyne, England, in 1926, Newcastle disease is common in Europe and in quite recent years has entered the United States, South Africa, Egypt, Canada, and Hawaii. For a number of years Britain was free from the disease, but it reappeared in 1947 and in 1950 became widespread. This is another price Britain has had to pay for importing food from infected countries.

Newcastle disease is difficult to eradicate. Many countries where it has appeared have been forced to accept it as one of the economic burdens they must carry. Vaccination has given only limited control. Mortality may be very high in young chicks, but in outbreaks among laying birds the death rate may be low. The principal loss in older birds is caused by the rapid and prolonged drop in egg yield and the production of misshapen eggs.

The symptoms may be similar to the ordinary manifestations of colds or coryza, accompanied by a rattle in the throat. The only certain diagnostic measure is the haemagglutination inhibition test carried out in a laboratory.

Infectious Laryngotracheitis

Another virus disease of poultry, infectious laryngotracheitis also occurs in most countries, including Australia. Symptoms include discharge from beak, nostrils, and eyes, coughing, and distressed breathing. Mortality may range from less than 5 per cent. to as high as 60 per cent. A feature of this disease is the frequent occurrence of "carriers" which, though apparently healthy, may spread infection.

Infectious Bronchitis

A respiratory disease of young chicks caused by a virus which has not been observed in New Zealand, infectious bronchitis may also affect laying birds, causing a decline in egg yield. The symptoms resemble those of other respiratory diseases. The birds sneeze and cough, and a crackling sound in the windpipe is typical. The course of the disease is very rapid and the condition is transmitted readily by affected birds.

Control in New Zealand

The diseases described in this article, though including some of the major epizootics, are by no means all which could gain entry to New Zealand, but they should give some idea of the difficulties in the way of maintaining the comparative freedom from serious animal diseases. The extension of veterinary services has added to the efficiency of control of diseases already present in the Dominion and, with improved methods of diagnosis, has also led to the discovery of some infections not previously known to exist here. However, the benefits of an adequate veterinary service must always be limited by the extent to which all farmers are prepared to co-operate in reporting diseases and in taking action to control them. The farmer thus holds the key to disease control within New Zealand.

◆

Care of Livestock during July

Contributed by the Animal Research Division

PULPY KIDNEY IN LAMBS

WHERE pulpy kidney occurs in lambs under 6 weeks of age its incidence can be reduced by vaccinating the ewes before lambing. If ewes have never been vaccinated before, best results will be obtained from 2 doses of vaccine given at least 1 month apart. Ewes which were vaccinated last year will require only one vaccination. The last (or the only) vaccination should be given about a fortnight before lambing and this can be done quite safely if ewes are handled carefully. Very poor immunity results where the ewes are vaccinated much earlier. If most losses from pulpy kidney occur in lambs over 6 weeks of age, vaccination of ewes is of no value, but vaccination of lambs at marking may help.

BLOOD POISONING IN EWES AND LAMBS

Losses from blood poisoning in lambing ewes and marked lambs appear to be increasing in some districts. They may be greatly reduced, if not eliminated, by vaccinating the ewes with blackleg vaccine about a fortnight before lambing. As the immunity which passes from the ewe to the lamb in the first milk does not persist for many weeks, lambs should be marked early. To obtain the best results it may be necessary to divide the ewes into early and late lambers, which should be vaccinated separately to ensure that all ewes are vaccinated from 10 to 20 days before lambing. Advice concerning vaccination can be obtained from any office of the Department of Agriculture. Where possible ewes should lamb in clean spelled paddocks, and lambs should always be marked in clean temporary yards.

SLEEPY SICKNESS IN EWES

Heavy losses from sleepy sickness sometimes occur in ewes carrying twins or heavy single lambs. These losses may be prevented by ensuring that ewes do not suffer a check just before lambing. If necessary, they should be divided into early and late lambers and drafted on to the best feed available 3 to 4 weeks before lambing. Research has shown that poor feed for 5 weeks before lambing can reduce the fleece weight by more than ½lb.

ERGOTISM IN CATTLE

Hay made from ergotised grass will cause lameness and sometimes even loss of feet in cattle. The small black ergots which replace the seeds of ryegrass and other grasses can easily be seen, and if they are present in large numbers, the hay should not be used. Similar trouble often occurs when cattle are grazed on tall fescue grass even when no ergots are present. This grass should be regarded as poisonous and should not be grazed by cattle.

WINTER FEEDING OF COWS

It is imperative that cows should be well fed for 6 to 8 weeks before calving. They should have access to hay at all times, and if the pasture is poor, they should also receive up to 20lb. of silage per day. Early-calving cows should be given about 2 hours' grazing per day on autumn-saved pasture and in addition should be fed as much silage as they will eat.

[*National Publicity Studios* photo.

Poor feed for 5 weeks before lambing can reduce the fleece weight of a ewe by over ½lb.

RINGWORM IN CALVES

Ringworm in calves is sometimes troublesome, especially in poorly nourished calves. Before applying any remedy the scales should be removed by rubbing in a mixture of equal parts of soft soap and lard and scraping off the softened scabs the next day. The bare patches should then be dressed with an ointment consisting of 1 part of salicylic acid and 8 parts of lard or any registered stock remedy for ringworm which is available. As the infection can be transmitted to man, it is wise to wear rubber gloves when treating ringworm. In any case the hands and arms should be thoroughly washed immediately after the dressings are applied.

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during April and for the 9 months ended 30 April 1952, with comparative figures for the same month and 9-monthly period of 1950-51, have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER

	Tons				
Period	Creamery	Whey	Total	% Inc. or dec.	Total tons in store at end of mth.
April 1952	8,656	194	8,850	—	23,797
April 1951	8,496	230	8,726	—	39,207
Inc. or dec.	+160	—36	+124	+1.421	—15,410
For 9 mths. to 30/4/52	151,220	2,529	153,749	—	—
For 9 mths. to 30/4/51	144,721	2,851	147,572	—	—
Inc. or dec.	+6,499	—322	+6,177	+4.185	—

CHEESE

	Tons				
Period	White	Coloured	Total	% Inc. or dec.	Total tons in store at end of mth.
April 1952	6,372	178	6,550	—	20,242
April 1951	8,443	—	8,443	—	31,074
Inc. or dec.	—2,071	+178	—1,893	—22.420	—10,832
For 9 mths. to 30/4/52	84,811	748	85,559	—	—
For 9 mths. to 30/4/51	94,167	1,526	95,693	—	—
Inc. or dec.	—9,356	—778	—10,134	—10.590	—

If these figures are converted into butterfat equivalent, there is an increase of 0.913 per cent. in butterfat graded for the 9 months as compared with the corresponding period of the preceding season. It should be noted that the above figures refer only to butter and cheese graded for export, and that owing to diversions which may take place from time to time, they are not necessarily a true indication of production trends.

Cereal Production and Feeding of Dairy Herds

Seasonal Notes by the Extension Division

PREPARATORY cultivation work for spring cereals should now be undertaken as weather conditions allow, and careful attention should be paid to the feeding of the dairy herd and the management of winter-saved pastures for late-winter and spring feeding.

WHEAT IN THE NORTH ISLAND

THE North Island makes a very small contribution to the wheat requirements of the Dominion. Less than 10,000 acres have been grown in the North Island over the past few seasons; and last season the area was below 7000 acres. It cannot be claimed that this small acreage is due to lack of suitable land or to an adverse climate. In the southern half of the island from Wanganui to Napier and south to Wellington there are upward of 1,000,000 acres of land suited to wheat growing and capable of producing crops in excess of 40 bushels per acre. The climate in these areas is generally favourable for the crop, with plenty of rain for growth, and except in the odd difficult season harvesting conditions are quite satisfactory. In the past decade few if any North Island wheat crops have been lost through weather conditions.

The new varieties (Tainui, Cross 7, and Hilgendorf), besides being good milling wheats and high yielders, are stiff strawed and resist lodging. Cross 7 is outstanding in this respect and is specially recommended for conditions where lodging can be expected. They are all spring wheats which mature quickly, Tainui being the earliest, but in these varieties the outstanding factor that reduces loss caused by the winds so prevalent in some of the best wheat-growing areas is their ability to hold the grain in the head. Crops left standing for many weeks awaiting favourable harvesting weather drop surprisingly little grain. Crops ready for cutting in early February have in fact been direct headed as late as March in very unfavourable seasons with yields of upward of 46 bushels per acre.

—*C. J. HAMBLYN*

* * *

SOWING BARLEY

THE preparation of land intended for barley is similar to that required for wheat or oats. The land should be ploughed to a good depth and a well-cultivated seed-bed developed. The fact that barley does not compete successfully with weeds largely determines the place it takes in the rotation. Barley is generally a spring-sown crop and may be grown after a cleaning crop such as roots or potatoes or after peas, wheat, or grass. It does not demand such a high fertility as wheat and can quite easily follow wheat in the rotation. In the drier districts barley can quite profitably be grown after a bare fallow following a previous barley crop. As a catch crop to provide winter feed it is sown in the autumn after a cereal. To provide feed to tide over the dry period in late summer and early autumn when feed is in short supply it may be sown in November or December.

Spring sowing usually begins in August and is carried on through September and October. Normally, the earlier the crop is in the stronger it is and the better the yields. For malting barley seedings range from 1½ to 2 bushels per acre; for greenfeed 2 to 2½ and even 3 bushels per acre are common, the heaviest rate being used when the seed is broadcast. The use of superphosphate at 1cwt. per acre is recommended. The normal depth of sowing is about 2in. and the land is harrowed following drilling. After the crop is up it may be harrowed if weeds are prevalent, but drastic treatment should be avoided, as barley is rather delicate in the seedling stage. In crops where Californian thistle is troublesome spraying the crop with the sodium salt of M.C.P.A. at the rate of 1lb. of acid equivalent per acre will give a temporary check, and in those districts where wild turnip occurs spraying at the rate of ½lb. of acid equivalent is sufficient.

BARLEY VARIETIES

Barley varieties are divided into feed and malting types. With the introduction of new malting varieties suitable for direct heading the older standard varieties Chevallier, Spratt Archer, and Plumage have lost favour. Research, a recently introduced Australian malting variety, is very suitable for direct heading. It is a short-strawed, early, but unevenly maturing variety giving good yields of only moderate-quality grain. It is not favoured by maltsters because of its uneven germination. A selection known as Mid-season Research has been made and is being multiplied. It is similar in most respects to Research, except that it has better grain quality and matures evenly. Golden Archer, a comparatively new variety, has given good results in field trials. It is a high yielder of good-quality grain. It stands well and is suited for direct heading. Kenia, another variety of recent introduction, has compared favourably with other varieties in trials. It is a short-strawed variety which stands well until header ripe, giving high yields of average-quality grain.

—*R. G. JOLLY*

* * *

WINTER-SAVED PASTURES

WINTER-SAVED pasture should not be allowed to grow more than 8in. high, and if this height is reached before the grass is needed for milking cows, the paddock should be lightly grazed for a short period to reduce the length of the grass slightly. This allows the sunlight to enter and prevents the yellowing of the base of the leaves. In some winter-saved pastures prairie grass grows strongly alongside the hedges. If allowed to continue growing, it will become unpalatable, and it should be fenced off and grazed short when it is about a foot high. This species makes a quick recovery and a second grazing is available in about 3 weeks. Winter-saved pasture is best utilised by rationing it to the herd with an electric fence. When the grass is 8in. high each cow needs 50 square yards per day, but an easier calculation for any sized herd is to allow 1 acre per 100 cows per day. The electric fence must be shifted daily. Shifting it twice a day, giving a fresh break for the day and another for the night feeding, does not increase production, but it does prevent some of the grass from becoming soiled. If the paddock to be rationed is narrow, the fence can be zig-zagged across it, moving each alternate end, but in a square paddock it can be moved around from a central post, thus shortening the length of wire to be handled daily.

SUPPLEMENTARY FEEDING

When feeding off winter-saved pastures the herd should be returned to the same paddock at night, but where the distance from the cowshed is too great for this to be done one paddock can be used for day grazing and one nearer the shed for the nights, but this system should not be practised unless absolutely necessary. If it is used, 100 cows will require 3/5 acre for the day grazing and 2/5 acre for night grazing. In addition to the winter-saved grass, cows need supplementary feeding and this should be continued as long as they will eat it. Besides the grass each cow requires 20lb. of silage and 12lb. of hay daily. This quantity should be fed out on the area that the cows grazed the previous day, as this deters the animals from grazing back over the area that is recovering from the earlier grazing. Provided access to water is easily arranged, a second electric wire can be used to prevent the cattle from grazing back, but only on large paddocks is this system worth while. A close watch should be kept on the stock droppings and the amounts of hay and silage altered to correct any deviation from the normal, more hay and less silage being used when the droppings become too soft.

—*G. A. BLAKE*

Fatal Farm Accidents

IT is recognised that some fatalities will occur on farms each year through **unforeseen** happenings, but many of the accidental deaths this year could have been **prevented**. A most serious aspect is the sharp rise in accidents involving tractors. Details of **these** and reference to a particularly distressing feature of fatal accidents on farms—**the deaths** of 9 children—are contained in this article by C. J. Crosbie, Machinery Instructor, Department of Agriculture, Christchurch.

FATALITIES caused by farm tractors rose from 9 in 1949 to 18 in 1950. Each of these 18 cases was described in the November 1951 issue of the "Journal". Collection of statistics related to farm safety has been continued, and in 1951 tractors were responsible for 12 fatal accidents, details of which will be published in the "Journal". In 3½ months of this year there have already been 11 deaths directly attributed to farm tractors and 3 in which tractors were associated but not directly responsible for the fatalities.

This alarming increase in the rate of fatal tractor accidents—almost as many deaths up to mid-April of this year as in the whole of 1951—is explained in part by two factors that have operated since the war, the increased numbers of tractors at work and the development of steep scrub-covered hillsides in the drive for greater production. However, examination of the facts about each case indicates that an increasing number of tractor drivers are not exercising sufficient care in operating their machines and in some instances have been grossly negligent. The facts briefly in the cases that have occurred this year were:—

1. A tractor was being loaded on to a truck when it slipped and pinned the driver under it for an hour before he could be released. He died from the injuries received.

2. With a hay baler attached a tractor was being turned on a hillside when it rolled over and killed the driver.

3. While mowing hay a driver endeavoured to turn on a steepish hillside and the tractor went into a skid downhill over a bank into a swamp. The driver was drowned in 3in. of water. By driving a little further on he could have turned on a comparatively safe area.

4. A driver giant discing a steep hillside put his small crawler on such an angle that it rolled over and crushed him. He lay for some hours unconscious before he was found and later died in hospital.

5. A 3-year-old boy was sitting on a tin on the footplate of a tractor being used to pull a 10-ton roller to push stones into the ground when the tin slipped off and he fell under the roller unnoticed while the driver was negotiating a corner and was killed instantly.

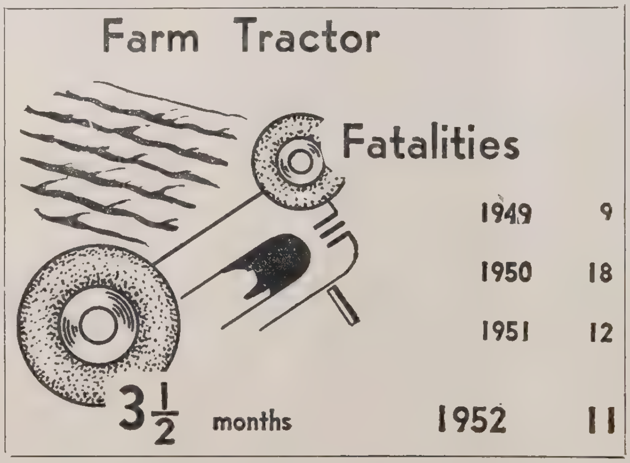
6. A bulldozer driver working on a farm road was found crushed under his machine and it is assumed that the accident must have happened the previous day.

7. A tractor with topdresser attached was moving downhill when it skidded and overturned, crushing the driver.

8. A 2-year-old boy on a tractor hitched to a trailer from which posts were being unloaded fell off when the tractor moved backward and was crushed by the rear wheel.

9. A man operating a tractor was found pinned to the ground by his head by the tractor seat after his machine had overturned.

10. A driver while topdressing was killed when his machine overturned on a hill slope.



11. A tractor driver who had been levelling a flat field was found dead with his neck caught against the drawbar of the tractor, death being due to asphyxia. He was subject to epileptic fits.

Tractors were associated with, but not responsible for, three more fatalities this year:—

1. A 13-year-old boy wearing a long coat on a cold day was riding on a direct-attached mower behind a tractor and using the seat for a hand hold. His coat became caught in the power take-off shaft, so that he was pulled down under the mower and suffered injuries from which he died. There was no shield over the power take-off shaft, although such a shield is provided by the manufacturers for just this purpose. The driver admitted prior knowledge of the use of this shield.

2. When playing in the field a 4-year-old girl ran in front of a roller drawn by a tractor and, unnoticed by the driver, was run over and killed.

3. A truck with a tractor on the tray ran off the road and rolled 300ft. down a steep hillside. The tractor driver, who was driving the truck, was killed.

Children's Deaths

A tragic feature of fatal accidents on farms is the number of children who have died. Of the total of 33 farm fatalities this year, 9 have involved children, whose ages ranged from 15 years to 14 months; 4 were killed by tractors or tractor-drawn implements, 1 was drowned in a stream passing through the farm, 1 was drowned in an uncovered sheep dip, 1 was drowned in a trough, 1 was accidentally shot when playing in a playhouse, and 1 was killed while mustering sheep when his horse slipped on steep country.

Though those on farms usually recognise that sheep dips constitute a a serious hazard, few dips are covered. Most spray dips are covered in with concrete, a few pot dips have covers made of wood because they are small and relatively easily covered, but rarely are swim-through dips protected. Even if wooden shutters cannot be fitted immediately, as they should be, no great effort is needed to roll out over the dip some netting wire supported by battens at regular intervals.

That proper and adequate storage of firearms and ammunition is not being exercised is painfully evident from examination of farm-fatality statistics for several years. They should be stored in a locked case or cupboard, but it is seldom done. All users of firearms should read the series of articles on the use and care of firearms by G. G. Kelly, Arms and Ballistics Officer to the Police Department, which have appeared in the "Journal" each month since the March issue.

Tractor-safety Field Days

Farm safety is largely a matter of common sense, and a little thought given to operations before they are carried out can avert many fatal happenings. The Department of Agriculture carries out a programme of educational work on farm safety each year and is willing to assist anyone who requires help.

Machinery instructors of the Department held a tractor-safety field day at New Plymouth recently at which many of the hazards associated with operating tractors on hill country were demonstrated and explained. Arrangements are being made for similar field days throughout New Zealand.

Home Vegetable Bulletin

The Department of Agriculture apologises for inability to supply copies of Bulletin No. 342, "The Home Vegetable Garden" to those who applied for them recently. However, the bulletin has now been reprinted and may be obtained from branches of Whitcombe and Tombs Ltd. or from offices of the Department at 2s. 6d. The bulletin, of which 10,000 copies have been sold, deals with all aspects of home vegetable growing in New Zealand and includes cultural details for all plants likely to be grown.

4000 Eggs in 48 Weeks Exceeded for First Time by Pen of Pullets in Breeders' Laying Trial

FOR the first time since the trials were begun, a pen of 20 pullets laid more than 4000 eggs in the 48 weeks of the third breeders' laying trial, which ended on 3 February of this year at the Department of Agriculture's Poultry Demonstration Plant, Upper Hutt. In this article F. C. Bobby, Superintendent, Poultry Industry, Department of Agriculture, Wellington, and R. Belworthy, Technician at the Poultry Demonstration Plant, review the results obtained from 24 pens of pullets.

[*Sparrow Industrial Pictures Ltd. photo.*

Mr. A. W. Hepburn with some of his birds on his admirably laid-out farm at Henderson, Auckland. His was the pen of 20 White Leghorn pullets which laid 4123 eggs in the 48 weeks of the 1951-52 breeders' laying trial, being the first pen to exceed a production of 4000 eggs in the period since the trials were begun in 1949. The same pen also had the greatest number of pullets accredited as breeding birds in the 1951-52 trial.

AGAIN there was a small increase in the number of pens entered, indicating that interest in this trial is still widening and that poultry breeders are finding it useful to have a pen of their pullets tested individually for production. This interest is being sustained in the current year, as the fourth trial has begun with 31 pens of pullets, or 620 birds.

Though it was felt at the start of the third trial that many of the pullets entered were below the standard of the previous year, average production for both heavy and light breeds was higher than for the two previous trials. Nevertheless, breeders should select pullets for the trial with the greatest care, avoiding underweight birds and those with obvious faults which will preclude their being used as breeding stock in their second year. The entering of such birds is a waste of money.

An innovation in the third trial was the dividing of the pens into two sections, the first and larger being fed as in previous trials on grain and wet mash, and the second receiving grain and unlimited dry mash. Consumption of both grain and mash by the second group was recorded accurately, with the primary object of measuring the efficiency of each pen as expressed by the quantity of food consumed for each dozen eggs laid. This food-efficiency test was conducted at the request of the Auckland Provincial Association of Registered Poultry-keepers and, though it is not being continued in the 1952-53 trial, it has produced some interesting data. Such a test adds considerably to the work of running the trial and recording the data.

Some poultry breeders with pens under test and other poultry producers visited the Poultry Demonstration Plant during the 48 weeks to inspect the trial. The manager and staff of the plant appreciated meeting some of those who had entered birds.

Entries for 1951-52 Trial

Entries for the third trial numbered 26 pens containing 520 pullets, an increase of 4 pens and 80 pullets over the second trial. Two pens were subsequently withdrawn by their owners, leaving 8 pens of Australorps and 16 of White Leghorns under trial. The birds in general travelled well, but some pullets were considered to lack condition on arrival. The trouble experienced after the first trial, when some pens took too long on the return journey, does not appear to have recurred.

Transport difficulties during the waterfront dispute prevented 2 pens of White Leghorns from being sent from the Oamaru district.

General Management

Each entry of 20 pullets was housed intensively in a pen measuring 14ft. x 12ft. Trap nesting was begun on 5 March 1951 and stopped 48 weeks later on 3 February 1952. All eggs from each pen up to a maximum of 6 per bird were weighed for 2 weeks in the 3rd, 6th, 9th, and 12th periods and the weights recorded on the trap sheets. The original trap sheet for each of the 12 4-week periods and post-mortem reports on birds which died were sent to pen owners.

Nineteen pens were fed grain and wet mash and 7 pens received grain and unlimited dry mash. All pens had greenfeed daily, oyster shell, metal grit, and water. A light feed of grain (about ½oz. per bird) was given early in the morning, wet mash to the larger group at 10.30 a.m., and a full grain feed late in the afternoon. Greenfeed was given at 1 p.m. On Sundays no wet mash was fed, but a full grain feed was given morning and afternoon; this is in line with management methods on the rest of the plant and reduces the Sunday labour.

The grain was a mixture of wheat, barley, oats, and maize, the last three being varied in quantity according to availability, time of year, and the condition of the birds. The mash mixture was:—

	lb.
Bran	22
Pollard	20
Wheat meal	24
Ground oats	7
Maize meal	10
Meat meal	15
Common salt	1
Oyster shell	1
	100

Fish oil containing 2000 international units of vitamin A per gramme was added to the mash at the rate of ¾ pint per 100lb.

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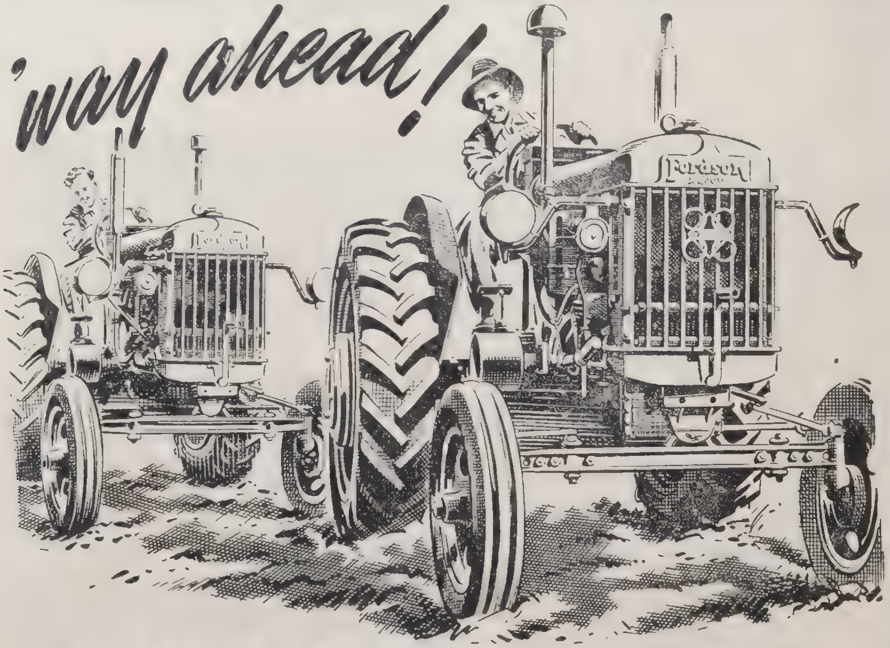

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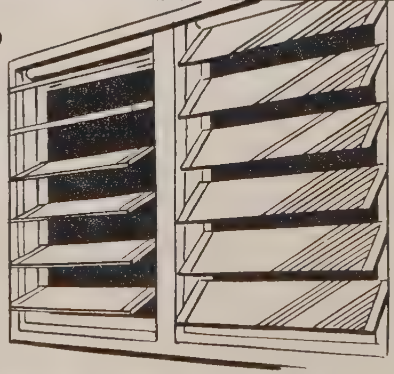

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Egg production of all pullets alive at the end of the trial and weights of the birds at the beginning and end of the 48 weeks are set out in the table below. All birds were examined at the end of the trial and judged for their quality as prospective breeders. The standard used for this purpose was:—

A pullet must have laid 180 eggs or more in the 48 weeks.

A preponderance of eggs of 2oz. or heavier must have been laid during the 4 periods of egg weighing.

At the end of the trial the bird must weigh the minimum laid down for the New Zealand Poultry Flock Improvement Plan—4½lb. for a White Leghorn and 5½lb. for an Australorp.

No pullet is accredited which carries a major breed fault or any body deformity.

Average egg production for both Australorps and White Leghorns showed an improvement over that of previous years, as is shown in the figures in the next column:—

Flock-housed average production per bird	1949-50	1950-51	1951-52
Heavy breed ..	149.6	175.0	178.2
Light breed ..	152.6	151.3	167.7

The flock-housed average is the total of eggs laid divided by the number of birds housed at the start of the trial. It is not based on the number of birds alive at the end of the trial; such a figure would look more attractive, but would be misleading and would give no credit to the breeder whose pullets had few or no losses.

As is shown in the graph on the next page, under conditions at the plant Australorps give better winter egg production and appear to be less affected by inclement weather.

Total and average productions for each pen, in order of merit, were:—

Pen number	Birds alive at end of trial	Total eggs produced	Flock-housed average production
	Australorps		
2 ..	17	3896	194.8
9 ..	19	3783	189.1
6 ..	16	3766	188.3
5 ..	19	3708	185.4
3 ..	16	3496	174.8
8 ..	16	3433	171.6
1 ..	15	3317	165.8
7 ..	12	2716	135.8
	White Leghorns		
23 ..	20	4123	206.1
21 ..	16	3958	197.9
14 ..	19	3790	189.5
19 ..	19	3753	187.6
15 ..	19	3654	182.7
20 ..	17	3598	179.9
25 ..	19	3583	179.1
16 ..	19	3539	176.9
13 ..	19	3508	175.4
26 ..	20	3373	168.6
11 ..	20	3227	161.3
12 ..	19	3203	160.1
17 ..	14	3150	157.5
24 ..	16	3021	151.0
18 ..	9	2148	107.4
22 ..	8	1714	85.7

BREEDER AND PEN NUMBER	WEIGHT (in pounds) OF EACH BIRD BEFORE AND AFTER TRIAL, AND 48 WEEKS' PRODUCTION OF EACH BIRD																				TOTAL FOR PEN (including floor eggs)
	Australorps																				
Green, Mrs. G. K. (1)	7-8 141	6½-6½ 248*	6¼-7¼ 180*	5½-5½ 214*	5¾-6½ 142	5½-6 124	5-6 189*	6½-6½ 231*	6-5½ 191*	5¾-6½ 173	6¼-6½ 207*	5½-6¼ 146	5½-6 242*	5-6 151	5-5 254						3,317
Willers, R. .. (2)	5½-6 213*	5½-6 218*	5½-5¾ 240†	5¾-6¼ 178	5-6¼ 203*	5½-5½ 177	5-4¾ 196	5-5½ 248†	5¼-5½ 219*	5-5½ 236*	5¼-6 209†	5¾-6 243*	5½-5½ 234	5¼-5¼ 210	4¾-5 218	5-5¼ 216	5¼-6 209*				3,896
Rosebank Stud Poultry Farm (3)	5½-6¾ 152	4¾-5¼ 166	5-5 230	5½-6 233*	5-5½ 211*	5¾-5 194	5-5¼ 208	6¾-7 168	5¼-5½ 228*	5¾-6 224*	5¾-6½ 249†	6½-5¾ 203*	6-6¾ 157	5½-6½ 246*	5¼-6 238*	6¾-7 217*					3,496
Dudding, E. C. .. (5)	4¾-7½ 261*	6-6¾ 195*	6-6¾ 233*	5-6¼ 186*	5-6 147	6½-6¼ 83	4¾-5½ 149	4¾-6 151	4¾-6 187*	4¾-4¾ 246	4½-6 193*	4½-6½ 142	5¼-6 225*	4¼-5¾ 158	4½-6 166	4½-6¼ 198*	4¼-7 227*	3¾-5½ 232*	4½-5¾ 222*		3,708
Smith, A. J. .. (6)	5½-5¾ 190*	4¾-5½ 271*	4¾-5¼ 191	5-6½ 212*	4¼-5½ 226	5-6½ 205†	5-5½ 194*	5-4½ 222†	5-7½ 193*	5¼-7 193*	4½-6 205*	5-6½ 172	4¾-6 187*	4½-6 238†	4-6 150	5-5¾ 227*					3,766
Driller, G. W. .. (7)	5½-6¾ 224*	4¾-5½ 257*	4½-5½ 199	5-6¼ 121	5-6½ 215*	4¾-5¾ 211*	4½-5½ 219*	5-5½ 227†	4¾-7 134	4¾-6½ 105	4¼-6 173	4-6½ 187									2,716
Young, G. H. .. (8)	5½-6½ 159	6½-7 230*	5¼-6 243*	6-8 204*	5¾-6 188*	6-7¼ 181*	5¾-6¼ 227*	6½-7 157	6-6½ 130	5¾-6 133	5-5½ 253†	5¾-6½ 236*	5½-5½ 234*	5½-6½ 122	5¼-6¼ 107	6¼-7 187*					3,433
Department of Agriculture (9)	‡-7½ 191*	‡-5¾ 207*	‡-5¾ 178	‡-5¾ 237*	‡-6 164	‡-6½ 177	‡-5 196	‡-5¾ 184*	‡-6 153	‡-6 209*	‡-5½ 204*	‡-5½ 217*	‡-7 178	‡-5 136	‡-6 181*	‡-6¼ 214	‡-6½ 189*	‡-4¾ 213	‡-3¾ 92		3,783
	White Leghorns																				
Hope, R. .. (11)	4-5 147	3¾-4½ 172	3¾-4¾ 111	3¾-4¾ 221	4-4¾ 45	3¾-4½ 130	4½-5 197*	4¾-4½ 191*	4-4½ 234*	3¼-5¼ 181*	3½-4 6	3¾-4½ 133	3¼-4¾ 155	3¾-4¾ 218*	3¼-4¼ 144	3½-4¼ 71	3-4¼ 240	3½-5 169	3¼-5 245*	3½-5 188*	3,227
Hepburn, A. W. (12)	3¾-4¼ 158	4-4½ 188	3½-4½ 172	3½-4½ 145	4-5 165	3¾-4½ 175	4¼-4¾ 174	3¾-5 —	4¼-4½ 161	3¼-4½ 212*	3¼-4 206	3¼-4½ 237†	3½-4¾ 176	4-5 161	4-5 184*	3¾-4¾ 129	3¾-4¾ 139	3½-4¼ 212	3¾-4½ 177		3,203
Boyd's Poultry Farm (13)	4¼-4¼ 231	4¼-4½ 205*	4-4½ 227	4-5 189*	3¾-4½ 132	4½-3¾ 73	4¼-4¾ 219*	4-4½ 133	3¾-4½ 169	4¼-4 218	3¾-5½ 131	4¾-5¾ 195	4¼-4½ 225*	4-4½ 142	4¾-5 224*	4½-5¼ 213*	4-4¾ 212†	4-4 127	3¾-4½ 185*		3,508
Burton, J. .. (14)	4-4 208	4¼-4¾ 222*	3¾-3¾ 212	3¾-4 209	3¾-4¼ 203†	3½-4 183†	3½-4¾ 12	3¾-4¼ 180	4½-5 218*	4½-5 187*	3½-3¾ 143	4½-5 163	3½-3½ 189	3¾-4 195	4-4¼ 241	4-4½ 229†	3½-4½ 247*	3½-3½ 132	2-4 191		3,790
Walker, G. A. .. (15)	4-4½ 198*	3¾-4¼ 215	4-4¾ 193*	4½-5½ 216*	4-4¾ 168	4-5¾ 108	4-5½ 238*	4-4½ 239*	4-5 128	3¾-4¾ 229*	3½-4½ 168	4½-5 184†	4¾-5 123	3¾-5¼ 154	3¾-4¼ 210	3¾-5¼ 149	3½-4½ 198*	4-5½ 253*	4-5 200*		3,654
Chamberlain, D. K. (16)	4½-5 160	4¼-4¾ 235†	4¼-4½ 171	4¼-4½ 188*	4¼-4¼ 172	3¾-4¼ 186†	4¼-4½ 164	4-4¼ 130	4-4½ 206†	4¼-5 186*	4¼-3¼ 141	4¾-5¼ 163	4¼-4¾ 220*	4¼-3½ 158	4-4½ 215*	4-3½ 161	4½-5 170	4-4½ 215†	4-4½ 222*		3,539
Close, J. A. .. (17)	3½-4¼ 250	4¼-4¼ 182	4-4 108	3½-4¼ 210	4-4½ 205*	3½-4½ 184*	3½-4½ 202†	3¾-4¼ 185	4-4 231	3¾-4½ 200*	4¼-4¾ 163	4¼-5 201*	4-4½ 175	5-5¾ 188*							3,150
Palmyra Poultry Farm (18)	4-4 191	3¾-4¼ 181	3¾-4½ 193*	3¾-3½ 144	4-4¾ 228*	3¾-3 2	3½-5½ 157	‡-6 175	‡-4¼ 244†												2,148
Kirk, M. J. .. (19)	3¾-4¼ 245	4-5 19	4¼-6 169	4-4¾ 189*	3¾-5 204*	3¾-4½ 256†	4-5 216*	4-5½ 159	3½-4¼ 199	4¼-5½ 158	4-3½ 139	5-6½ 194*	4½-6½ 196*	4-5 150	4½-6 213†	3¾-4½ 208*	3¼-4 245	3¾-5 240*	‡-4½ 240†		3,753
Hetherington, R. W. (20)	3½-4½ 199*	3½-4½ 178	3¾-5½ 168	3½-5 232*	3¼-5 219*	4-5 202*	4-5 203*	4-5¼ 189	4-5 197*	3¾-5 197†	4-5¾ 261	3¾-4¼ 198	3¾-4½ 202*	3¾-5½ 213*	4-5½ 159	4-5½ 219*	4-5 118				3,598
Bradley, C. L. .. (21)	3¼-5 222*	4-5½ 177	3½-4 214	4-4½ 220*	4-4½ 246*	3½-4¼ 198	3-3¾ 148	4-4½ 194*	3¾-4¾ 218*	3¾-4¾ 213*	3¾-4½ 277†	3¾-4½ 206†	3¾-4¼ 158	4-4¾ 170	4¼-4½ 226*	3¾-4½ 248*					3,958
Palmyra Poultry Farm (22)	4-4¾ 177	3¼-4 175	4-4¾ 219†	4-6 152	4½-5½ 148	3¾-5¼ 200*	‡-5 46	‡-4¼ 99													1,714
Hepburn, A. W. (23)	4-5½ 208*	3¾-5¼ 202*	4¼-5½ 198*	3½-5 187*	4¼-6 159	4-5½ 206*	3¾-5¼ 218*	3¾-5 237*	3½-4¾ 198	4-5½ 165	4-4½ 188*	3¾-5 159	3¾-4½ 140	3½-5 126	4¼-5 197*	3½-4¼ 248	4¼-5¼ 246*	3¾-4½ 197*	3¾-5 133	4-5½ 180*	4,123
Chapman, H. E. (24)	5-6½ 165	4¼-5½ 171	4½-6 195*	4-6¼ 193*	4-4½ 129	4-5 113	4½-5¼ 172	4¾-6¼ 168	4¼-5¼ 215*	4-5 158	4¼-5½ 222*	3¾-4¼ 199	4-5½ 189*	4¼-5½ 184*	4¼-5 231*	4-4¾ 197*					3,021
Sinclair, J. G. .. (25)	3¾-4¼ 206	4¾-5 181	4½-4¾ 182*	4¼-4½ 199*	4½-4¾ 206*	4-4½ 208*	4¼-4¼ 210	4¼-4½ 233*	3½-4½ 196*	4-4¾ 194*	4¼-4 159	3¾-4¼ 189	3½-3¾ 174	3-3½ 200	4-4½ 171	4¼-4¾ 168	4½-4¾ 109	4¾-5 186*	4½-4¾ 173		3,583
Bolton, T. A. .. (26)	5-5¾ 171	4-5½ 187*	4½-5¼ 100	4¾-5½ 197*	4½-5 213*	4¼-5½ 201*	4½-5 19	4-4½ 190*	4-5¼ 165	4¼-4¾ 205*	4¾-6¼ 53	4½-5¾ 178	4¼-5½ 177	4½-5½ 201*	4-5¼ 176	4½-5¼ 201*	4¼-4¾ 206*	5-5½ 127	4¼-5¼ 193*	4-5½ 145	3,373

Only birds alive at end of the trial are recorded.
* Accredited breeding stock. † Egg size unsatisfactory. ‡ Bird not weighed before trial.

A. W. Hepburn's Pen 23 of White Leghorns was the first since trials were begun to lay 4000 or more eggs in 48 weeks. C. L. Bradley's pen of White Leghorns missed this distinction by only 42 eggs.

Accredited Breeding Birds

The trial is held essentially with the object of finding prospective breeding stock. Owners of pens which obtained the most accreditations are:—

Australorps: E. C. Dudding, Hastings, 11.

White Leghorns: A. W. Hepburn, Auckland (Pen 23), 12.

The accredited bird with the highest production was A. J. Smith's Australorp with a total of 271 eggs. Among the White Leghorns the accredited pullet with the highest total, 253 eggs, was owned by G. A. Walker.

Egg Size

Of Australorp pullets which laid 180 eggs or more 9 could not be accredited as future breeding birds because of unsatisfactory egg size, and of the White Leghorns 19 failed to gain accreditation for the same reason. Some of these birds were particularly high producers and may start their "hen year" with larger eggs, but they showed a weakness that should be watched.

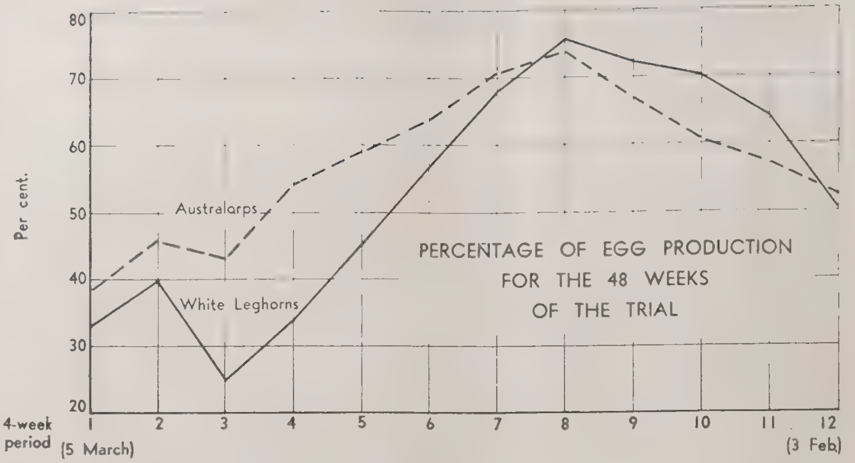
Unrecorded Eggs

The number of unrecorded eggs was the lowest to date in these trials. The figures were 1.9 per cent. for the heavy breed and 1.2 per cent. for the light breed as against 3 per cent. and 2.5 per cent. for the previous year's trial.

Food Consumption and Costs

The following figures show food consumption for all pens under both systems of feeding:—

4-WEEK PERIOD	FOOD PER BIRD (lb.)		
	Wet mash	Grain	Total
1	2.9	3.8	6.7
2	3.4	4.1	7.5
3	3.7	3.7	7.4
4	3.9	3.4	7.3
5	4.1	3.5	7.6
6	4.6	3.9	8.5
7	4.6	3.9	8.5
8	4.7	3.9	8.6
9	4.4	4.3	8.7
10	4.4	4.5	8.9
11	3.7	3.7	7.4
12	3.5	3.5	7.0
48 weeks ..	47.9	46.2	94.1
	Dry mash	Grain	Total
1	3.5	3.3	6.8
2	3.6	4.1	7.7
3	3.3	3.5	6.8
4	4.1	3.3	7.4
5	4.3	3.3	7.6
6	4.3	3.6	7.9
7	4.9	3.5	8.4
8	5.0	3.5	8.5
9	4.9	3.4	8.3
10	4.8	3.2	8.0
11	4.8	3.3	8.1
12	4.6	3.9	8.5
48 weeks ..	52.1	41.9	94.0



PERCENTAGE OF EGG PRODUCTION FOR THE 48 WEEKS OF THE TRIAL

That total consumption under each system of feeding should be almost the same is a remarkable co-incidence. Direct comparison between these two sets of figures is not completely permissible, as the birds given wet mash included 8 pens (160 birds) of Australorps and those on dry mash were all White Leghorns.

Three Years' Feeding Costs

With similar food-consumption figures for the wet-mash and grain system of feeding during the previous two trials, the cost of feeding laying pullets for 48 weeks during the past 3 years can now be compared:—

	1949-50	1950-51	1951-52
Mash (lb.) ..	41.5	45.6	47.9
Grain (lb.) ..	47.5	47.1	46.2
Total food (lb.)	89.0	92.7	94.1
Cost	15s. 8d.	18s. 2d.	23s. 2d.

The 1951-52 costs are based on the prices paid in April 1952 by the Poultry Demonstration Plant for both mash and grain and include the cost of the fish oil incorporated in the mash. No charge has been included for oyster shell and metal grit.

Food-efficiency Test

The table at the foot of this page gives details for the 7 pens entered in the food-efficiency section of the trial. That there is an appreciable difference between food utilisations of birds of varying quality is well illustrated. The figures are also of interest for comparison purposes to farmers taking part in the efficiency-recording scheme being conducted by the Department of Agriculture at the request of the New Zealand Poultry Board.

Mortality

Figures for mortality in the trials for the past 3 years show an increase in deaths among the heavy breed for the third trial and a continued decrease in the losses among the White Leghorns. Indeed, if the unusually heavy losses in 2 pens of White Leghorns are discounted, a marked improvement is evident in the remaining pens of this breed. Figures for the past 3 years are:—

Percentage mortality	1949-50	1950-51	1951-52
Heavy breed ..	12.5	10.8	19.4
Light breed ..	18.1	16.2	14.4

A summary of the causes of deaths as reported by the Animal Research Station, Wallaceville, is given below. Again the most serious losses have been caused by leucosis, a disease which causes more poultry losses in the Dominion than any other. This fact emphasises the importance of the work being carried out at the Poultry Demonstration Plant to breed strains of both Australorps and White Leghorns resistant to this disease.

Cause of death	Heavy breed	Light breed
Egg peritonitis	2	3
Obstruction of trachea ..	—	1
Coccidiosis	1	4
Vent picked	1	3
Leucosis	13	19
Prolapsis of rectum ..	—	1
Prolapsis of oviduct ..	2	—
Impaction of crop ..	3	1
Impaction of gizzard ..	3	—
Visceral gout	—	2
Worms	—	2
Cystic kidneys	1	2
Rupture of liver	1	—
Vent gleet	—	1
Lesions (vitamin A deficiency)	—	1
Staphyloccal infection ..	—	1
Cystic oviduct	—	1
Injury	1	3
Obstruction of bowel ..	1	—
Blindness	1	—
No significant findings ..	1	1
Totals	31	46

FEEDING COSTS IN TERMS OF EGG PRODUCTION

Pen number	Owner	Birds alive at end of trial	Hen-housed flock average of eggs	Food (lb.) per dozen eggs laid	Cost of food per dozen eggs
21	C. L. Bradley	17	197.9	5.3	1s. 1d.
23	A. W. Hepburn	20	206.1	5.8	1s. 2¼d.
19	M. J. Kirk	19	187.6	5.9	1s. 2½d.
20	R. W. Hetherington	18	179.9	6.4	1s. 3¾d.
24	H. E. Chapman	16	151.0	6.7	1s. 4½d.
18	Palmyra Poultry Farm ..	10	107.4	7.7	1s. 7d.
22	Palmyra Poultry Farm ..	8	85.7	8.5	1s. 9d.

FARMING IN NEW ZEALAND

Levels County

HEADING PHOTOGRAPH: Typical downlands of Levels County.

By R. C. SCHOFIELD, Instructor in Agriculture, Department of Agriculture, Alexandra

LEVELS COUNTY, with its areas of flat land, downland, and higher hill country and a farming pattern ranging from sheep-grazing farms to the more intensive, mixed arable farms, where cereal crops are grown and fat lambs are produced, is typical of much of South Canterbury.

THE county occupies roughly a triangular area of 168,320 acres with the coastline between the Opihi and Pareora Rivers as the base. The northern boundary for its entire length follows the Opihi River. The southern boundary follows the Pareora River for about 14 miles from the coast and then crosses to Cave, whence it follows the Tengawai River for 8 miles and then goes across country to meet the Opihi River about 4 miles below Fairlie.

Historical

Levels County is part of the original Levels Station which was taken up by George Rhodes in 1850. The vegetation of the area was mainly tussock and matagouri (*Discaria toumatou*) and apart from small areas of native bush there were no trees except cabbage trees (*Cordyline australis*). Toward the sea lay great stretches of impassable swamp and in the Cave district there was an extensive area of rough country in native vegetation where snowgrass (*Danthonia flavescens*) was up to a man's waist.

In 1851 Levels Station carried 7000 sheep, all Merinos, but by 1868 the total had risen to 102,061. Sheep were not permitted to wander at will, owing to a scarcity of horses and the rough country, and mobs were attended by shepherds on foot. Lambing took place all the year round and occasionally expensive stud sheep were purchased to raise the quality of the wool, and wool washing before shearing was practised. Agricultural operations were on a small scale until the 1870's.

In 1865 the New Zealand and Australian Land Company purchased 6317 acres from Rhodes and by 1877 the company had bought 103,349 acres of the Levels Station. More attention was paid to agriculture after the company bought the land. Cultivation was done mainly by a system of contract ploughing by neighbouring settlers, this system offering them an opportunity to start on their own farms and eventually to increase the area of the farms.

During this period before the use of refrigerated ships farming practices centred around production of wool, wheat, and to a less extent oats. Once refrigeration became established and frozen lamb and mutton could be exported the Merino ceased to be the dominant breed of sheep and good meat-producing breeds were preferred. More attention was given to fattening of lambs and feeding of stock generally.

During the late 1890's the Government purchased the land owned by the New Zealand and Australian Land Company and soon opened up for settlement the first block of 1554 acres. In 1904 the Government opened the Rosewill Settlement of 37,560 acres, which extended in the vicinity of the Timaru-Fairlie branch of the railway from Levels railway station, 7 miles from Timaru, to Albury, 29 miles from Timaru. This area was subdivided into 128 farms of from 12 to 879 acres with two small grazing runs of about 1800 acres each in addition to village and suburban sections. A further 2267 acres divided into 11 farms was opened for settlement at Claremont in 1912.

Farming in the county has developed from the large Levels Station to the present farms, on most of which mixed cropping is associated with sheep and cattle grazing. Sheep farming entirely is confined to the steeper, broken, and unploughable hill country and to the colder areas of the downs. Some dairy farms have been developed on the fertile soils in the county. The only change in dairy farming there has been brought about by the growth of the population of Timaru, which has resulted in some farms supplying town milk instead of sending their produce to dairy factories.

Topography

The county can be divided into three main topographical units: Flat country, downlands, and strongly rolling to steep country.

Flat Country

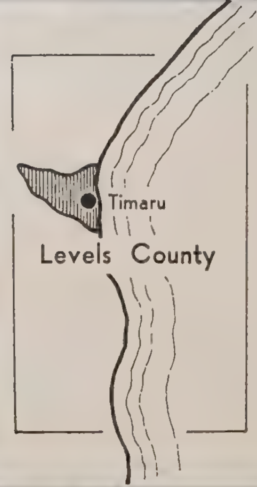
The principal area of flat country extends from a point about 3 miles to the east of Cave to the coast and is bound in the north by the Tengawai River as far as its junction with the Opihi River and from there by the Opihi River to the coast. In the south the approximate boundary is the Timaru-Fairlie railway line from Washdyke to near Cave. This area is the southernmost portion of the extensive Canterbury Plains and with a slope of about 25ft. per mile it rises to a height of 300ft. near Cave.

Other areas of flat country occur throughout the county along the rivers and valleys in the downlands, the chief areas being in Totara Valley and in the south-eastern portion of the county around Pareora.

Downlands

Downlands cover most of the county. They occur in two areas separated by the flats along the Tengawai River between Cave and Pleasant Point. The larger area extends from the coast between Pareora and Washdyke to the

CASH CROPS IN LEVELS COUNTY



Upper left—About 600 acres of potatoes are grown in Levels County, the main variety being Aucklander Short Top. Upper right—Harvesting a crop of wheat on the plains. At left—Cutting a white clover seed crop. Lower left — Branding and sealing certified ryegrass seed. Production of high-grade pasture seed is a feature of farming in the county. Lower right—Rape for seed is a crop of importance on parts of the county. It is windrowed and threshed by header.

[*Upper right photograph by E. F. Neilson.*

Tengawai River between Cave and Pleasant Point. The smaller area covers the portion of the county between the Tengawai and Opihi Rivers. Rising inland with a slope of about 80ft. per mile the whole series of rounded valleys and spurs has a gently undulating appearance, although there are some steep escarpments.

Strongly Rolling to Steep Country

Strongly rolling to steep country extends as a ridge along the southern boundary for some distance. The land, which is from 1200 to about 2000ft. high, runs in a south-easterly direction from the north-west corner of the county to Mt. Horrible. Between the Tengawai and Opihi Rivers there is rough and broken country with steep sandstone and limestone escarpments.

Effect of Topography on Utilisation

On the flats and easy downlands the choice of crop varies considerably, but on the strongly rolling country cropping is restricted mainly to fodder crops. Some steeper parts have been ploughed and sown down to permanent pasture with the object of maintaining these areas for as long as possible without renewing them. Much of the permanent improved pasture has reverted to browntop.

Part of the county is too steep to improve it by sowing it down to pasture and on this land there are extensive areas of gorse.

Climate

The plains and downlands of the county lie in the 20 to 25in. rainfall belt and in the higher country the annual precipitation is nearly 30in. Timaru, on the coast, has an average annual fall of 23.16in. and Fairlie, which is a few miles outside the county boundary to the north-west, has a fall of 29.73in. Although the highest precipitation occurs in summer (Timaru normally receives 30 per cent. of its rainfall from December to February), the effectiveness of this rainfall is reduced considerably by drying north-west winds, which are prevalent at this time of year. Consequently pasture growth is restricted and it is necessary to grow supplementary fodder crops for sheep fattening. However, these dry conditions are very favourable for the harvesting of cereals and grass seed.

Because of relatively low temperatures and the number of ground frosts in winter, supplementary feed for stock has also to be provided for winter. The lowest average mean monthly temperature on the coast is about 41 degrees, in July, when about 20 ground frosts are experienced. The highest mean monthly temperature on the coast is 61 degrees, in January, which thus gives an annual range of nearly 20 degrees. Inland the temperature range is greater.

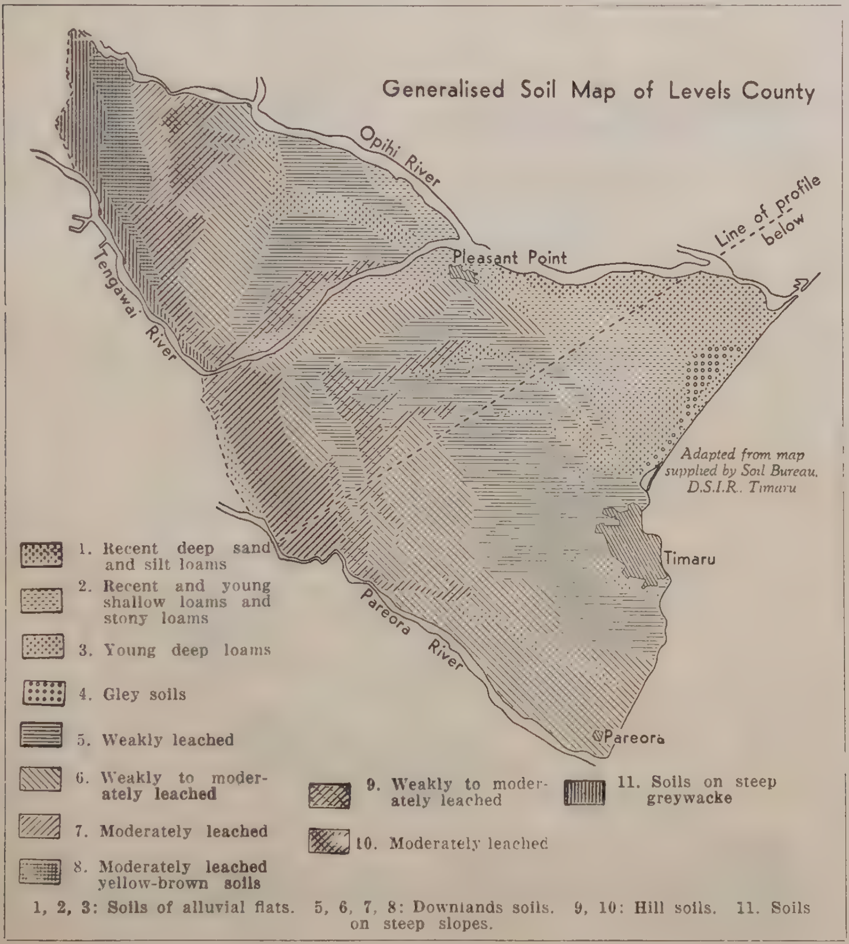
The prevailing winds are from north and north-east, a disadvantage of these winds sometimes being that they bring coastal fogs, which affect harvesting of late crops such as Montgomery red clover. The main rain-bearing winds are from north-east and south-west and the north-western tip of the county receives some summer showers from the north-west.

Soils (See Map)

The soils of the flats are derived from alluvial deposits. The largest areas of flats, the southernmost portion of the Canterbury Plains, were formed during a period of severe climate accompanied by extensive glaciation. The glaciers poured tremendous quantities of boulders, shingle, sand, and silts into the rivers, which spread this waste in huge, easy-sloping fans. Some of the soils of the flats are derived from the glacial deposits, but in other places more recent deposits of finer flood sediment cover the earlier deposits, giving rise to more fertile soils. The soils of the valley bottoms of the downlands are derived from the alluvial outwash of the downlands.

Soils of the downlands are derived mainly from the fine wind-borne dust known as loess. Over a large portion of the area the loess rests on river-laid gravel hundreds of feet thick. However, over an area of about 50 square miles between Mt. Horrible and the coast and between Washdyke and Pig Hunting Creek there is a basalt lava flow underlying the loess and resting on the gravel beds. This basalt flow originated at Mt. Horrible and flowed down toward the coast. Rock from the flow has been quarried for foreshore-protection work.

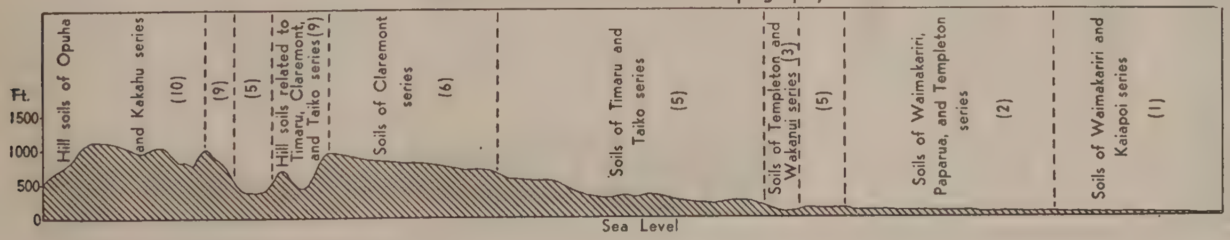
The gravel beds overlie a succession of coal measures and marine beds.


Generalised Soil Map of Levels County
Opihi River
Line of profile below
Pleasant Point
Tengawai River
Timaru
Pareora River
Pareora
1. Recent deep sand and silt loams
2. Recent and young shallow loams and stony loams
3. Young deep loams
4. Gley soils
5. Weakly leached
6. Weakly to moderately leached
7. Moderately leached
8. Moderately leached yellow-brown soils
9. Weakly to moderately leached
10. Moderately leached
11. Soils on steep greywacke

Adapted from map supplied by Soil Bureau, D.S.I.R., Timaru

1, 2, 3: Soils of alluvial flats. 5, 6, 7, 8: Downlands soils. 9, 10: Hill soils. 11. Soils on steep slopes.

Profile of Soils in Relation to Topography


Ft.
1500
1000
500
0
Hill soils of Opuha and Kakahu series
(10)
(9)
(5)
Hill soils related to Timaru, Claremont, and Taiko series(9)
Soils of Claremont series
(6)
Soils of Timaru and Taiko series
(5)
Soils of Templeton and Wakanui series (3)
(5)
Soils of Waimakariri, Paparua, and Templeton series
(2)
Soils of Waimakariri and Kaiapoi series
(1)
Sea Level

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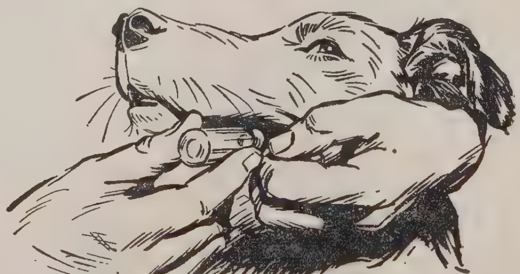

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which in turn overlie the greywacke rock of the mountains. Soils derived from greywacke occur in a small area in the far west of the county. The marine beds include limestone beds which outcrop through the district and are quarried for agricultural lime at Cave, Sutherlands, and Limestone Valley.

The loess, a very finely ground glacial sediment, which was fed into the rivers by the glaciers, was picked out of the river-beds by wind, which deposited it in great depths on top of the gravels and the basalt flow. That this loess deposition must have been spasmodic over a long period is shown by evidence of soil formation at several levels in the loess.

The main groups of soil are soils of the alluvial flats, soils of the rolling downs, and hill soils.

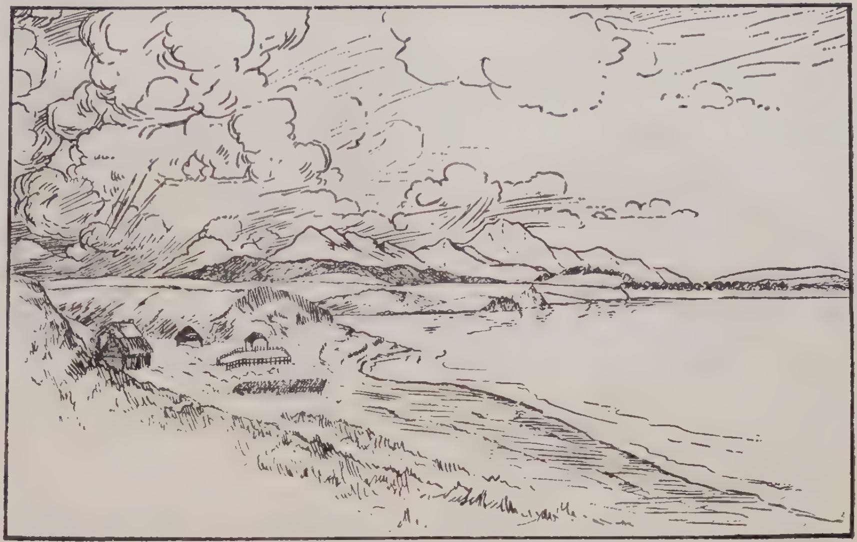
Soils of the Alluvial Flats

Soils of the alluvial flats are remarkable for their variation, the depth to the underlying gravel and boulders varying considerably. Silt and sand loams from several inches to feet deep are common and in places there are many stones and boulders. Textures vary from the desirable crumby structure on the best loams to powdery sands on the poorer areas.

1. **Recent deep sand and silt loams:** This group of soils includes several types of the Waimakariri series: Deep silt loams and deep sand loams, small areas of shallow soils, and a small strip of slightly saline soils along the coast. There is also a small area of Kaiapoi sandy loam, which has a higher moisture status than the Waimakariri soils. All these are highly fertile soils of recent origin. They have a good supply of all plant foods, but tend to be droughty and are subject to flooding. Wheat, oats, barley, peas, rape for seed, and potatoes are common cash crops and yields are fairly high.

These soils maintain a short-period permanent pasture of perennial ryegrass and white clover, which under irrigation is capable of producing 65 bushels of machine-dressed ryegrass seed per acre. Wide variations occur in the choice and place of crops in the rotation. In seasons of low rainfall and high temperatures the sandy soils tend to become overdrained and growth is restricted, particularly on non-irrigable areas.

2. **Recent and young shallow loams and stony loams:** This group includes most of the stony soils of the Levels plain. They are of moderate fertility, but are droughty. The group also includes stony soils of the Waimakariri, Paparua, and Templeton series. Little cash cropping is done, because of the nature of the soils. Oats are a more payable crop than wheat, which is grown after a period of fertility build-up with forage crops. An important crop is rape grown for seed. As the soil is only moderately fertile, leaf and stem is not bulky and the crop can be headed. Most of the farm income on these soils comes from sheep. Cultivation is costly and the extent to which it can be done depends on the amount of stones and boulders present, less-stony areas being relatively intensively cropped, with the result that over the whole of some farms fertility has been lowered. On the deeper and less-stony loams good cereal and forage crops and crops of rape for seed can be grown when conditions are favourable.



Part of the original Levels Station, which was taken up by George Rhodes in 1850. This reproduction is from an early pencil sketch inscribed: "Messrs. Rhodes' home station on the beach at Timaru with a view of Arowhenua bush on the plains and Talbot Forest".

Pastures are difficult to establish, and where there is a tendency to over-crop, pastures soon deteriorate and reversion to hairgrass and flat weeds is rapid. There is a definite place for subterranean clover on these soils, though it is not being grown successfully in South Canterbury mainly because of indiscriminate grazing in the first year, when it must be allowed to reseed if it is to persist. The ability of subterranean clover to raise the fertility and carrying capacity of these soils must be exploited; once it is established its future production and existence depend on its receiving adequate supplies of superphosphate and lime.

On irrigated areas of this soil a more permanent and vigorous type of pasture can be established, but dressings of lime and superphosphate are essential for clover growth and subsequent improvement.

Grass-grubs are a serious pest on these loams, and in addition to ruining pasture they have caused serious damage to rape crops for seed. Damage to rape has been aggravated by aphis attack in seasons favourable to its spread and crops have been poor.

3. **Young deep silt loams:** These soils occur in the valley bottoms of the downlands and on the Levels plain near Washdyke. They are of moderate to high fertility and do not dry out as rapidly as groups 1 and 2. They belong to the Templeton and Wakanui series. Linen flax and linseed are grown in addition to wheat, oats, barley, peas, and a small acreage of rape for seed. Pastures are slower coming away in spring than those on soils of groups 1 and 2 and much slower on the back faces, but production is maintained well into summer and reversion to inferior types of grass does not take place as rapidly as on soils of groups 1 and 2.

4. **Gley soils:** A small strip of gley soil (Temuka series) occurs in the Seadown area. Gley soils are poorly drained to swampy, but when drained are moderately or highly fertile. These soils are well suited to dairy farming, but crop production is risky. Drainage is a problem, even on some dairy farming areas, but land which can be drained satisfactorily and higher ground can be cropped successfully. Small numbers of beef cattle are fattened and young dairy stock reared for sale.

Soils of the Rolling Downland

5. **Weakly leached soils:** Soils of the Timaru and Taiko series occur in the dry areas of the county and are of moderate to high natural fertility, though they tend to be droughty. These soils have been cropped extensively.

6. **Weakly to moderately leached soils:** These soils (Claremont series) are more leached and more gleyed (wetter) than the Timaru series. They are in an area which has a higher rainfall and they do not dry out to the same extent as the soils in group 5. They respond better to lime and superphosphate than do the soils of group 5.

Crops of linen flax, linseed, wheat, barley, oats (occasionally), rape for seed, and potatoes are raised on soils of groups 5 and 6. The intensity of cropping depends largely on the size of the holding. There is a tendency on soils of group 6 for farms to be larger, cropping to be more extensive, and for pastures to be down longer. There has been some increase in dairy farming on these soils, back faces and gullies providing fairly reliable and nutritious feed for dairy stock in addition to grazing pastures and supplementary feed. Some beef cattle are carried on this area.

The main seed-producing areas of the county are on soils of groups 1, 2, 3, parts of 4, 5, and 6, and in favourable years pockets of browntop pasture are harvested for seed on other soils.

7. **Moderately leached soils:** A small area of these soils (Opuha series) occurs north-east of Albury. These soils are more gleyed and of lower natural fertility than those of groups 5 and 6 and show a greater response to lime and fertilisers.

8. **Moderately leached yellow-brown soils:** These soils, which occur in the higher parts of the county near Albury, are of the same fertility as group 7, but are free-draining and the climate where they occur is cooler and moister. They respond well to lime and fertiliser.

Hill Soils

9. **Weakly to moderately leached:** This group includes hill soils related to Timaru, Claremont, and Taiko series. Large areas of this group are in silver tussock (*Poa caespitosa*) and matagouri with small areas of native shrubs and gorse. These soils are worked with soils of groups 5 and 6. Browntop invaded the area, which is steep and unploughable, and is now the dominant grass. Sheep and cattle grazing is the main farming activity.

10. **Moderately leached:** This includes hill soils of Opuha and Kakahu series. They are of lower fertility than group 9 and carry a fair cover of scrub and gorse.

11. **Soils on steep greywacke:** A small strip of steep soil related to the Omarama series occurs along the steep western face of the Brothers Range near Albury. They are moderately fertile soils, but are moderately to severely eroded.

Land Utilisation

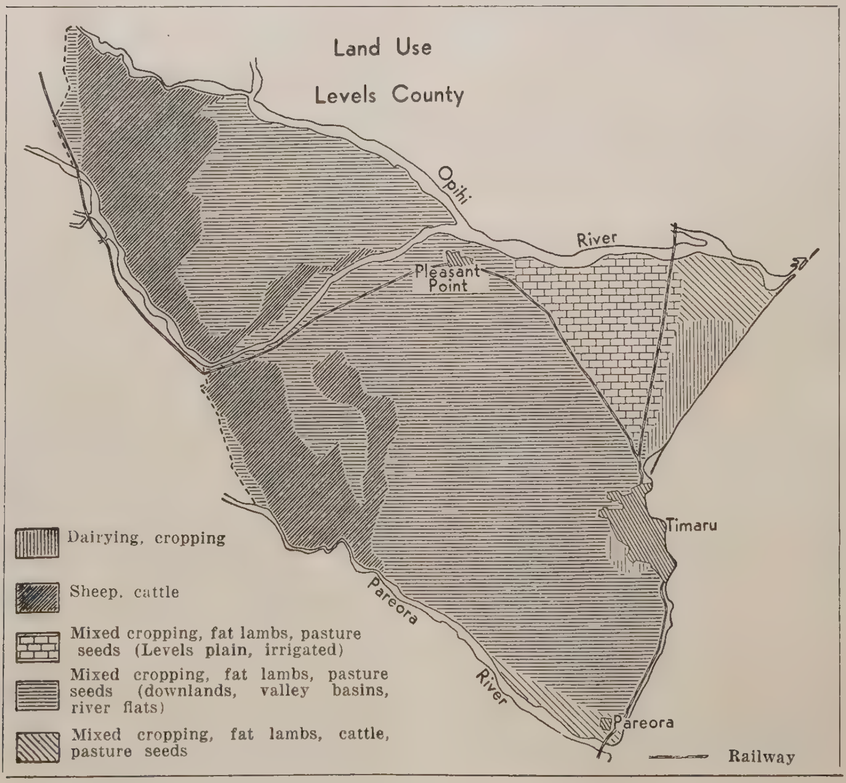
Of a total occupied area in Levels County of 161,130 acres, 105,700 acres is in sown grasses, clovers, and lucerne. Much of the unimproved land is browntop pasture and when this is included the total grassland area of the county has an average carrying capacity of about 1.9 ewes per acre. Approximately 9 acres of fodder crops are required for each 100 ewes. In 1948-49 cash crops accounted for 13,900 acres, of which 54 per cent. was in wheat for threshing. In that season also the area of sown grasses and clovers set aside for seed was 6628 acres or 6.3 per cent. of the sown grass area, the highest percentage of any county in Canterbury. This demonstrates the relative importance of small-seed production in Levels County.

TABLE 1—UTILISATION OF LAND AND STOCK CARRIED IN LEVELS COUNTY, 1948-49

	Acres
Sown grasses, clovers, and lucerne	105,695
Cash crops	13,919
Fodder crops	16,737
Fallow land	2,985
Plantations, orchards, gardens	2,539
Total sheep	255,548
Breeding ewes	179,085
Total cattle	10,325

Crop Production

The breaking in of the plains and ploughable downlands was not difficult, though cultivation was haphazard—little more than a ploughing before sowing to turnips and wheat. Wheat became the most important crop before refrigeration was introduced, particularly when the county become more closely settled. Very little attention was paid to restoration of soil fertility. However, to benefit from the market opened up by refrigeration farmers had to provide winter feed for their stock and this led to a form of crop rotation—a winter fodder crop followed by a cereal or vice versa. With a greater diversity of crops, present-day efficient management recognises crop rotation of pasture and restorative forage crops, lime and fertiliser to build fertility, and cash crops to utilise this induced fertility as the most effective method of maintaining soils and obtaining maximum production.


Land Use
Levels County
Opihi
River
Pleasant Point
Timaru
Pareora River
Pareora
▥ Dairying, cropping
▨ Sheep, cattle
▦ Mixed cropping, fat lambs, pasture seeds (Levels plain, irrigated)
☰ Mixed cropping, fat lambs, pasture seeds (downlands, valley basins, river flats)
▧ Mixed cropping, fat lambs, cattle, pasture seeds
Railway

Cash Crops

Wheat: Considerable areas of wheat have been grown since the 1860's and in the past 30 years the acreage has at times exceeded 20,000, which is approximately 12 per cent. of the total area of the county.

This was the position immediately after the First World War, but later the acreage declined to 15,000. In the depression years of the 1930's the wheat acreage again increased, reaching 20,053 acres in 1932-33. Since then, except for a period during the Second World War, the trend has been downward and in 1948-49 only 7439 acres were grown.

The fertility of an area largely determines how often a crop of wheat can be taken from it. On the lower fertility soils of group 2 wheat is grown occasionally, but on more fertile soil wheat may be taken about every 7 years.

Cross 7 is the most popular variety. Normally wheat is sown after a series of pilot crops, usually forage (swedes, chou moellier, turnips, or rape), though on the downs linseed and linen flax are favoured. Variations occur in the rotation adopted, but wheat is seldom grown after pasture.

Oats: Mainly due to the decline in the number of working horses, oats are not now grown much in the county. The area of oats for chaff declined from 6193 acres in 1920 to 2102 acres in 1949. A proportion of the acreage is used for sheep feed and some for the racing stables in the county. From 6904 acres in 1920 the area of oats for threshing fell to 2076 acres in 1949. The area fed off is determined largely by prices offering for feed oats either as chaff or grain. Oats usually are sown in autumn after wheat on the better soils, but after a forage crop on the lighter soils, where the crop is more payable than wheat.

Barley: In the past the acreage of this crop was small. From 1922 until 1945 the acreage did not exceed 600, but in 1946 it reached 1478 acres and in 1948 2324 acres. The wet season in 1946 probably made it necessary to sow a crop other than wheat and barley was found to be reliable. On the more moisture-retentive alluvial flats and downs even ripening and satisfactory yields up to 60 bushels can be expected. Usually barley is sown after wheat, occasionally as a cover crop to spring-sown pasture, though as a cover crop it is seldom satisfactory.

Barley sometimes is direct headed, but usually it is headed from the windrow. Golden Archer, Plumage Archer, Spratt Archer, Chevallier, and Research are the main varieties grown.

Paddock of Cross 7 wheat at Kingsdown. The area in wheat in Levels County has at times exceeded 20,000 acres, which is about 12 per cent. of the total area of the county, but in 1948-49 only 7400 acres were put down in this crop.

Peas: Only in the three seasons from 1942 to 1945, when 684, 1705, and 1282 acres respectively were sown, was much interest taken in this crop, the area before this period being very small and confined to deep loams. Field peas follow pasture in the rotation and are a good, reliable pilot crop for wheat, as little cultivation is required before drilling of the wheat.

Potatoes: The area in potatoes declined from about 900 acres in the early 1920's to approximately 500 acres at the beginning of the Second World War, increased to 1383 acres in 1945, and dropped rapidly to 640 acres in 1949. Potatoes are not an important crop in the county, but where they are grown endeavours are made to secure the best seed. In addition to local seed, lines are obtained from the better seed-growing areas of Mid- and North Canterbury. Potatoes follow pasture in the rotation, and if the ground is not worked too fine, an even crop is assured. The main variety is Aucklander Short Top and there are small areas of Arran Chief and Inverness Favourite.

Rape seed: Rape for seed as a cash crop is important on soil of group 2, where it is usually sown after pasture. The soil does not have to be very fertile, as seed not leaf and stem is required. However, on the soils of the downs, where fertility is higher than desirable for seed production, conditions are adjusted by growing linseed and linen flax before the rape seed crop to utilise some of the fertility. Rape for seed is autumn sown, and if the yield is to be good, it must have a growing period that allows it to establish well before winter. The average yield of seed is about 7cwt. per acre. The crop is windrowed and threshed by header, but yields have been higher when the crop is tied and stooked.

Linseed and linen flax: The climate and the soil of Levels County are admirable for growing linen flax and linseed. From 640 acres in 1941 the area in linen flax increased to 1690 acres in 1945, then dropped to 598 acres in 1949.

Interest in linseed as a crop has never been great and it is only since 1946, when 812 acres were grown, that interest has been stimulated by a good price. Experiences with linen flax and the fact that soil and climatic requirements for linseed are similar was, in association with price, probably the deciding factor in an increase in the acreage of linseed.

On the downs linseed has an important place, as it is another reliable cash crop and fits well into the rotations grass-linseed-wheat or grass-linseed-rape (seed). The main variety of linseed grown is Golden Viking, which occasionally has been direct headed, but usually is windrowed and threshed by header.

Forage Crops

Because of the climate, dry summers and relatively cold winters, the provision of summer and winter forage

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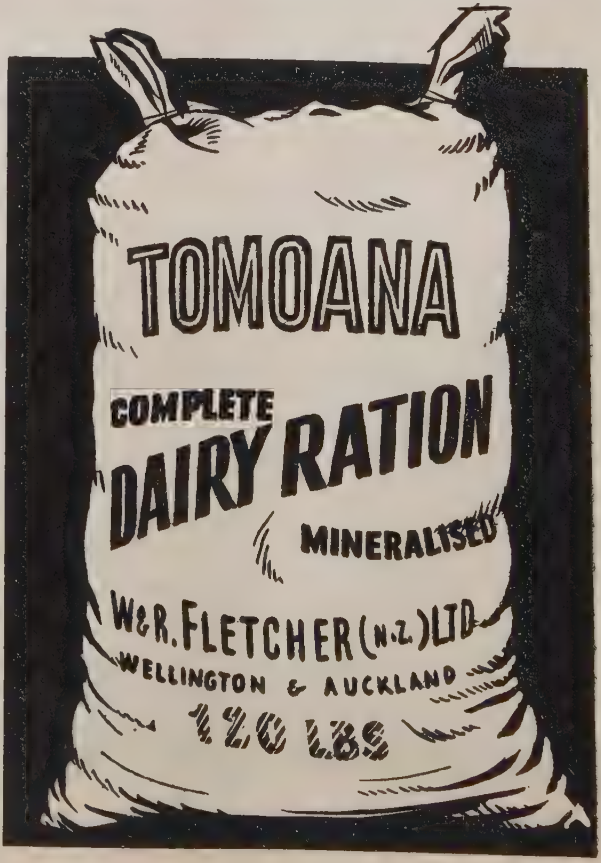


Linseed in bloom. Interest in linseed as a crop has increased in recent years.

crops is essential. In 1948-49 the total area devoted to these crops was 16,700 acres.

Rape: Over the past 30 years there has been little variation in the area sown to rape, between 4500 acres and 6000 acres being grown each year. Usually it is sown before or after a cash crop and is the main summer supplementary fattening crop.

Turnips: This crop, the basic supplementary winter feed, is fed off in breaks. It is grown on the plains and downs and on many areas is the only winter feed grown. Turnips were favoured until a few seasons before the Second World War, but since then swedes and chou moellier have become more popular. As moisture-retentive soils provide better conditions for growth than drier soils, crops on the downs usually yield better than those on the plains. Usually turnips are sown after grass. The soft turnip Purple Topped White is the main variety grown, and when sown late its lasts well into winter. In 1948-49 3807 acres of turnips were grown.

Swedes: About 2000 acres of swedes are grown each year, and the crop is confined mainly to the deeper alluvial soils and to the colder downs, where excellent yields are obtained when the moisture supply is adequate.

Chou moellier: The area of chou moellier has increased considerably since 1938 and in 1948-49 nearly 1400 acres were grown. The crop is confined to the downs and deeper alluvial soils. Turnips are a more satisfactory crop on the droughty alluvial soils and where the climate is severe. Chou moellier sometimes acts as a canopy crop to swedes and turnips.

Sowings of 2 to 3lb. an acre are made when the crop is required for sheep feed, this sowing giving a dense area of small plants, but for dairy stock, sowings usually are of 1lb. per acre, which gives tall, thick-stemmed plants. The crop is sometimes cut and fed out and sometimes fed off in breaks.

Mangolds: In the past 10 years the area in mangolds has dropped from about 400 acres to about 100 acres and the crop now is of minor importance.

Greenfeed: Oats and barley were of importance in providing feed for sheep during periods of low pasture production in early spring, as a flushing feed for ewes before tupping, and to a less extent for milking cows in spring and autumn. However, the area of oats and barley used for feed crops fell steadily and recently has seldom exceeded 1000 acres per year.

Hay: Until 1940 the area of grasses and clovers cut for hay or silage seldom exceeded 2000 acres per year, but since that time the area has not dropped below that figure.

TABLE 2—AREA OF GRASSES AND CLOVERS CUT FOR HAY OR SILAGE

Year	Acres	Year	Acres
1919–20 ..	747	1939–40 ..	1115
1924–25 ..	1301	1944–45 ..	2134
1929–30 ..	662	1948–49 ..	2554
1934–35 ..	2800		

Most of the hay is saved in the Seadown area, where the larger dairy herds are carried. On the other flat areas and on the downs little hay is saved, as the emphasis is on seed production; the residue of the seed crop may be baled or left as pickings for stock.

The area in lucerne has increased in recent years; in 1939-40 there were 371 acres and in 1948-49 982 acres.

Pastures

One of the main benefits to the county from the widespread interest in pasture-seed production is that greater interest is being taken in pastures and more attention is being paid to good seed and seed-bed preparation. The area sown with cover crops is rapidly decreasing and the practice of fallowing before sowing down pasture is being more widely adopted. Increasing use of better pasture species, lime, and fertiliser and the benefits from stock grazing have been reflected in a renewal of fertility and ability of the land to hold white clover after years of having been "mined".

Pastures in the county vary according to the use to which they are put.

Temporary Pasture

Temporary pastures vary according to the length of life required and the use to which pastures are put—feed and seed crop or crops or feed and possibly hay.

The simplest and shortest-term temporary pasture is Italian ryegrass sown on a fallow in January or February and grazed from April through winter until October, when it is shut up for a seed crop, after which it is ploughed. The life of this pasture can be extended by the inclusion of white clover, which does not detract from the usefulness of the pasture for seeding both for Italian ryegrass and white clover. This practice is widely used with short-rotation ryegrass and gives a useful life of about 3 years.

Where the saving of seed is not contemplated cowgrass is used and such a temporary pasture gives excellent grazing as well as the prospect of hay crops.

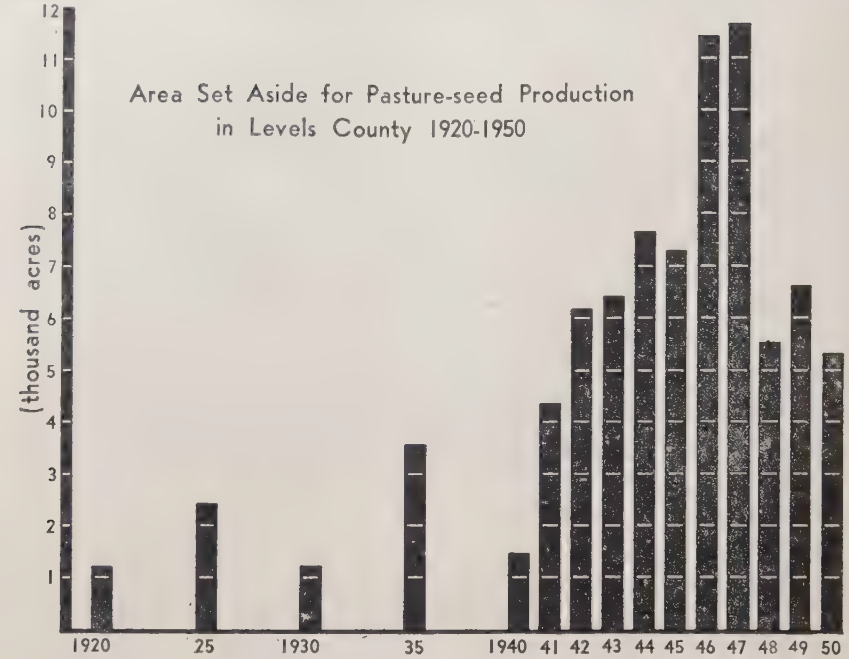
Short-term Pasture

Though pasture species vary considerably, the basic pasture is perennial ryegrass-white clover. On most of the soils of the alluvial flats and easier rolling downs pastures are renewed every 4 to 6 years. On the more fertile moisture-retentive soils under good conditions reversion is slow and as a result swards are predominantly ryegrass and white clover with little Yorkshire fog, goose grass, browntop, and flat weeds. However, if these pastures are neglected, they will revert rapidly to browntop. On droughty and less fertile soils the pastures consist mainly of a thin, low-producing sward of perennial ryegrass and white clover which rapidly reverts to browntop, sweet vernal, Yorkshire fog, and flat weeds. On the heavier alluvial soils reversion is mainly to hairgrass, Yorkshire fog, and sweet vernal and on the lighter alluvial soils to hairgrass and yarrow. On the low-producing pastures some suckling clover appears in spring.

It is from short-term pastures that most of the seed in the county is produced and for that reason sowings are mainly of crested dogstail, perennial ryegrass, and white clover. Occasionally areas are sown primarily for grazing and seed mixtures are varied accordingly, Montgomery red clover, perennial ryegrass, dogstail, and white clover being the main constituents.

Long-term Pastures

As supplementary winter feed crops are essential, pasture renewal is a



routine practice. The so-called long-term pastures, on dairy farms and on the larger farms, have a normal life of not more than 10 years. Crested dogstail is an important constituent of these pastures, as it is more persistent than ryegrass and does not require such fertile conditions, it resists invasion by browntop in a dense sward, and during the life of a pasture it contributes valuable feed. To maintain long-term pastures it is essential to lime them adequately, and to extend their period of grazing a wider range of species must be used in pasture mixtures.

The useful life of a long-term pasture depends not only on a satisfactory seed-bed and preparatory liming, but to a great extent on keeping as dense a cover of grass and clover as possible over the main growing season—spring and summer. Weeds grow vigorously during these periods and only a vigorous, well-managed sward can compete with them and persist.

A long-term pasture mixture used is as follows:—

	lb. per acre
Short-rotation ryegrass ..	5
Crested dogstail	2
Perennial ryegrass	15
Cocksfoot	4
White clover	2
Montgomery red clover ..	3
Timothy	3
Total	34

Permanent Pastures

In Levels County permanent pastures are confined to steep hill country, unploughable alluvial flats, downlands, and swamp areas. On the steep hill country and the swamp areas a wide range of species exists, but the remainder of the area in permanent pasture is dominantly browntop with sweet vernal, hair-grass, and Yorkshire fog.

Pasture-seed Production

Small-seed production has been a feature of farming in the county for some years, and since 1940 there has been a very large increase in the area set aside for the purpose. In the past four seasons seed has been harvestd from between 5000 and 6000 acres.

TABLE 3—AREAS OF GRASSES AND CLOVERS CUT FOR SEED

Year	Acres	Year	Acres
1919–20 ..	1222	1939–40 ..	1409
1924–25 ..	2421	1944–45 ..	7296
1929–30 ..	1245	1949–50 ..	5320
1934–35 ..	3583		

Lime and Fertilisers

The practice of applying lime before sowing down pastures and as a maintenance ration on pastures has become widespread in the county. The lime status of the soils varies considerably, it having been found essential to lime extensively over a period of years to bring soils to good condition for crops and pasture. The usual practice is to apply 1 to 1½ tons before sowing down pasture and a considerable area of pasture is topdressed with 1 ton per acre every 4 to 6 years. Some autumn-sown pasture is topdressed the year following sowing down, mainly on the seed-producing areas.

Usually crops receive 1 to 1½cwt. of superphosphate per acre, though the application is heavier for potatoes. Grassland which is normally topdressed receives about 1 to 2cwt. per acre of superphosphate at sowing down and the same amount in each of the two years after sowing.

The establishment of limeworks in the county and the development of several bulk-sowing transport units have been important factors responsible for the increasing use of lime.

Sheep

First predominantly Merino, the flocks in the county changed to fine-woolled half-bred and then to the coarser-woolled crossbred. By 1920 the main breeds were crossbred ewes and Border and English Leicester rams. The dominant ram now is the Romney (in 1950 26 per cent. of all rams in the county were Romneys) and the dominant ewe is the Romney crossbred. The Romney is used on the foothills, where lamb fattening is difficult, on the steeper downlands, and to a less extent on the easier downlands and flats where breeding flocks are kept.

The Border Leicester is used mainly on the steeply rolling downlands and on the drier plains, where pasture is not vigorous and the growing of rape is essential for lamb fattening, as in these parts the Down cross lamb does not do well.

On the easy rolling downs and plains, where pastures are renewed fairly often, farms usually are smaller than on the poorer country and have been developed more intensively. There Southdown rams are used mainly. With good feed conditions, a fairly good proportion of lambs is sent away fat off the mothers, the remainder being fattened on rape and crop residues. More Ryeland rams have been used in recent years, approximately 7 per cent. of the rams in the county being of this breed, as Ryelands produce bigger lambs less susceptible to checks than the Down lambs and yielding more wool.

Increase in Breeding Ewes

The number of breeding ewes in Levels County has increased steadily from 99,480 in 1920 to 179,080 in 1949. Fluctuations have been slight, the fall in numbers during the depression of the 1930's being due largely to a rise in the acreage in cash crops.

Annual replacements of sheep, mainly 2-tooth and full-mouth ewes, for the plains and downland, come from the foothills in the county and the foothills of South Canterbury. A notable contribution comes from farms on the easier downs and plains which breed their own replacements, their surplus stock being cleared at the annual ewe fair held at Pleasant Point.

Cattle

Beef Cattle

Since 1920 there has been little fluctuation in the total of beef cattle, which usually has been between 6000 and 7000. They are used on the rougher downs to control roughage and they are also carried on many sheep farms throughout the county. On the wetter areas around Seadown they are bought as 2-year-olds, fattened during summer, and then sold.

The relative unimportance of cattle can be appreciated from the fact that there are approximately 2.9 cattle per 100 sheep shorn.

Dairy Farming

Dairy farming has never been of importance in Levels County, although with the settlement of servicemen on farms after the First World War there was an increase in dairy cow numbers. The total rose from 3586 in 1920 to 5425 in 1924, but soon fell, and except for an increase in the depression of the 1930's the general trend has been downward. In 1949 there were 3702 dairy cows in milk, many of which are in herds which supply milk to Timaru.

Irrigation

The need to supply water by some method to the lighter and drier pastures of the Canterbury Plains has always been recognised, and the Levels plain, which is really the southernmost section of the Canterbury Plains, has been affected severely in the past by recurrent dry spells. In 1937 the Levels Irrigation Scheme, the second State scheme in Canterbury, was opened and it serves a considerable part of the Levels plain, commanding a total area of 12,000 acres. Only a small area is irrigated in any year; for instance in 1949-50 water was applied to 1891 acres. Many farmers in this area adopt a fairly intensive cropping programme and pastures are thus renewed frequently; the area of pasture to be irrigated depends on the area in crops and fallow. If more land is to be irrigated, cropping must be less intensive, which would call for more pasture and increased stocking.

Downlands Water Supply Scheme

On most of the downs of South Canterbury provision of adequate water for stock and household purposes was a problem, and usually dams were erected in natural catchment areas, but in dry seasons they frequently went dry. To overcome the problem the State developed what is now known as the Downlands Water Supply Scheme. Water is drawn from the Tengawai River to 6 reservoirs, from which it is delivered through deeply laid pipes to the farm troughs and houses. An area of 135,600 acres in South Canterbury is served by the scheme and in addition to stock drinking water the scheme supplies 960 houses. Levels County is well catered for and water for stock is no longer a problem.

Farm Management

Farm management in Levels County is determined largely by topography and there are five broad systems.

Mixed Cropping and Grazing (Non-irrigated)

Mixed cropping, pasture-seeds production, fat lamb raising, and cattle grazing are carried on on non-irrigated land on the Levels plain of soil groups 1 to 4.

Over much of this area small-seeds production is important. On group 1 soils less emphasis is placed on production of seed, which is harvested only when conditions are favourable, priority being given to grazing for stock. Where farmers are fortunate in having areas of the more moisture-retentive soil (group 4) small-seed crops are harvested regularly. On such farms stock are used to control the seed areas until they are shut up and the stock are then moved on to wetter areas.

Farmers buy in 2-year-old steers or older cattle, depending on what is offering during autumn, fatten them in winter on hay, baled seed-crop residues, and chou moellier, and sell them in September.

Sheep replacement methods vary from buying ewe lambs and 2-tooths to purchasing full-mouth or 2-year ewes. Ryeland, Border Leicester, and Southdown rams are used. About half of the lambs are sold fat off the mothers, the remainder being fattened on rape and pasture. Common practices in these areas are to buy in lambs and fatten them on crop surpluses and residues and to sell grazing.

A typical good farm on these soils is one of 260 acres carrying 475 Romney-cross ewes, which are mated with Southdown rams to lamb about 20 August. The average lambing percentage is 110. From 40 to 50 per cent. of the lambs are sold fat off the mothers, the remainder being fattened on pasture. Two hundred ewe hoggets are bought during April or May for annual replacements, of which usually 180 are required.

Up to the present 12 steers bought during autumn have been run and sold the following January, but future policy will be to run 30 to 40 calves annually, buying and selling as for steers.

The rotation adopted is: Old grass, wheat, barley, chou moellier, fallow, new grass. Grass to be sown to wheat is skim ploughed at the beginning of April, grubbed two or three times before the last week in May, rolled and ploughed, and sown by mid-June. Alternatively, on the freer-working paddocks the land is grubbed 4 or 5 times with a narrow-tine grubber before the last week in May, rolled and ploughed, and sown by mid-June. Wheat stubble is ploughed in June and sown to barley by the end of September. From barley the area is sown in early January to chou moellier at the rate of 4lb. per acre, which gives a mass of thin-stalked plants that is handled readily by stock.

When the chou moellier area is cleared up it is skim ploughed, to get under any roots, during September and twice again by the end of December. During early January it is deep ploughed (about 6in.) and harrowed.

Yields of up to 85 bushels of wheat and 90 bushels of barley per acre are obtained.

Pasture is sown at the rate of 25lb. of perennial ryegrass, 4lb. of white clover, and 2lb. of dogstail per acre, only the best-grade seed being sown. One ton of lime is applied and worked in before the pasture mixture is broadcast.

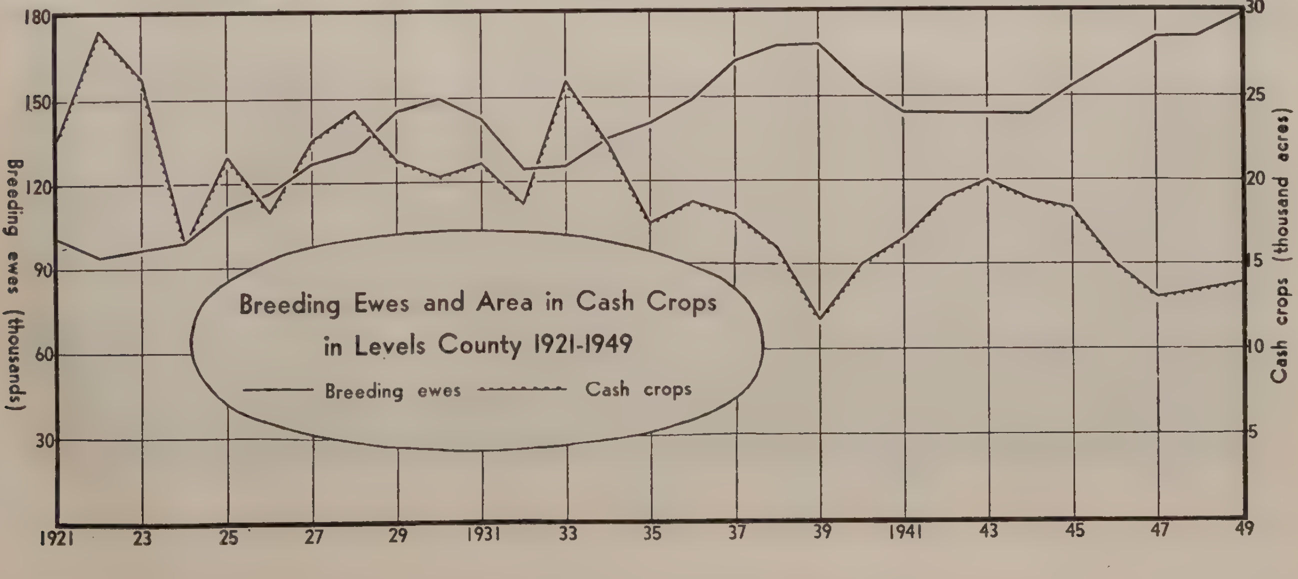
Usually 30 acres of new pasture is closed for perennial ryegrass seed production and 15 acres for white clover seed, yields of 50 to 65 bushels of machine dressed ryegrass and 200lb. of white clover per acre being general. Ryegrass seed areas receive 100lb. of sulphate of ammonia annually at closing time and all pasture areas from which a crop has been taken receive 1cwt. of superphosphate per acre.

The saving of hay is normal practice, approximately 10 acres being reserved for this purpose in addtion to seed-crop residues baled for winter feed.

Mixed Cropping and Grazing (Irrigated)

Mixed cropping, fat lamb raising, and small-seeds production are carried on on the Levels plain on irrigated land of soil groups 1 and 2.

Parts of soil groups 1 and 2 are in the irrigated area and water is applied on land of soil group 1. Rotations are many and varied and a fairly



intensive arable agriculture has developed on many farms. The breeding of replacement stock is common, leading to more even Romney flocks. Hoggets are often grazed out during winter.

Cultivation can be done earlier and over a longer period than on other soils. Subterranean clover provides considerable feed in spring and early summer.

A farm on this soil type where irrigation is attempted on a large scale is one with a combined area of 708 acres, of which approximately 280 are used by cash, forage, and seed crops and fallow ground.

The flock comprises 1500 breeding ewes, and 400 to 500 sound-mouthed ewes are bought each year for replacements. Ewes are mated with Southdown rams, and lambing (average 120 per cent.) begins the first week of September. Usually 50 per cent. of the lambs are sold fat off the mothers, but at times the figure has reached 80 per cent. The remainder are fattened on pasture and some rape. Store lambs are often bought for fattening.

Approximately 30 acres each of wheat, oats, barley, rape (seed), and turnips are grown annually and in addition a small area of rape (10 to 20 acres) is grown for finishing off some of the lambs.

On this farm, on which there are different soil types, it is found an advantage to adopt various rotations suited to particular soils. One rotation on the lighter, stonier soil may be grass, turnips, fallow, oats (Grey Winter), grass. Whether oats will be harvested for grain is determined by the season; if feed is plentiful in spring, the oats will be harvested for grain, otherwise they are fed off. Another rotation may be grass, turnips, rape and grass or grass, rape, and Italian ryegrass, fallow, grass. Rape may be irrigated in summer and autumn. When rape is sown for seed it follows grass; after the rape crop has been taken the land is sown in oats and grass or grass sown down in autumn. Rape is not grown for fodder to any extent, as more satisfactory fattening feed is derived from irrigated pasture.

Ground broken out of grass for any crop is ploughed about 5in. deep during June or July and left until late September, when it is hustled every 10 days or so until sowing time, when the area is harrowed, rolled, and harrowed again before drilling. In north-westerly weather it may be necessary to repeat harrowing and rolling to bring up moisture in an attempt to ensure an even strike.

The pasture mixture used is 20lb. of perennial ryegrass, 5lb. of Italian ryegrass, 2½lb. of white clover, 2lb. of dogstail, 2lb. of Montgomery red clover, and 2lb. of subterranean clover. However, on the deeper, more moisture-retentive soils the mixture is altered to 25lb. of perennial ryegrass, 3lb. of white clover, and 2lb. of crested dogstail. Each paddock receives 1 ton of lime at sowing down and 2cwt. of superphosphate the next year.

Approximately 12 acres of lucerne is grown and is irrigated immediately after each cut, 4 annually, but with exceptional seasons irrigation may start earlier than this and the crop may require two waterings between cuts during part of the season. The yield is between 3½ and 4 tons per season.

The main feature of this farm is that every paddock is prepared for irrigation whether in crop or pasture. Each paddock is more often border diked than border ditched before pasture is sown so that in the event of dry conditions water can be applied. An old grader is used for putting up the levees when diking and an Australian ditcher when putting in the border ditches.

Mixed Cropping and Grazing (Downlands)

Mixed cropping, fat lamb raising, and pasture-seeds production are carried on on downlands, valley basins, and river flats of soil groups 2, 3, 5, and 6. Much attention has to be given to cultivation practices on these soils. Annual weeds are a problem, and if cultivation is rushed and land improperly worked, crops can be hampered seriously by weeds.

One farm of 375 acres on this soil type carries 650 ewes and 240 hoggets. Some of the ewes are mated with Romney rams to provide replacement stock and the remainder are mated with Southdown rams. Lambing begins about 13 August and the average is 120 per cent. Lambs are sold fat. Usually 180 2-tooths go into the flock annually. The object in breeding replacement stock is to build up a good ewe flock and so overcome the need to attend a series of ewe fairs in an endeavour to buy good, even lines.

When taken over by the present occupier in 1935 the property, on which wheat had been grown regularly, was smothered in yarrow. Half the farm was fallowed and sown to grass.

Work is planned so that cultivation is never rushed and consequently pasture goes in under good conditions.

Not more than 40 acres of wheat is grown annually, but 60 to 80 acres of new grass is planned for seed production and for ewes to lamb on.

Two rotations are adopted, the main one, for 30 to 40 acres being: Grass, rape, wheat, fallow, grass sown in January or February. The second, for about 20 acres is grass, turnips, fallow, grass. When it is found that the area to be autumn-sown to new grass is less than 60 acres, to maintain the area a grass paddock will be ploughed about May and fallowed through and sown in autumn with the main sowing, thus maintaining a planned 60 to 80 acres of new grass.

Land broken out of grass for turnips and rape is ploughed during May and June, which ensures that the turf rots sufficiently, and drag harrowed when conditions are favourable in spring (about the end of August). The area is then left at least a fortnight, grubbed, and later grubbed fortnightly until sowing time, when a stroke or two with the harrows is sufficient to provide a satisfactory seed-bed. Rape is sown in two breaks, the first during the last week of October and the second (for the tail-end lambs, which

Typical mixed farming country of the downlands.

[*E. F. Neilson photo.*

Above left—Pleasant Point ewe fair. Many farmers on the flats and downlands obtain their replacements from this sale. Above right—Yearling Herefords and ewes and lambs on ryegrass-white clover pasture at Pleasant Point.

are nibbling on wheat stubble and pickings until the rape is ready) about 3 weeks later.

Turnips (Imperial Green Globe) are sown in Christmas week, the shells of the fed-off crop are grubbed during September, and the ground is ploughed when in good condition and fallowed in preparation for sowing down to grass.

All rape is cleaned up by the end of March, it being necessary normally to buy some lambs to use the crop. Wheat is sown in May; a feature of production is that whereas from 1935 to 1942 the average yield was 50 bushels per acre, from 1943 to 1950 it was 60.

Wheat stubble is burnt during March, after stock have cleaned up any feed, and ploughed during April. The area is grubbed in spring and fortnightly until January.

Immediately harvesting is completed the fallowed ground is grubbed, drag harrowed across the grubbing, rolled, and light harrowed twice. This is then followed by the roller with the drill behind trailing harrows, seed being sown through the broadcast box and fertiliser being put down the coulters. Pasture is always sown broadcast, the mixture used being 25lb. of perennial ryegrass, 3lb. of white clover, and 2lb. of crested dogstail.

About 60 acres of grass and the same area of white clover is saved for seed annually. Lime at the rate of 1 ton per acre is applied in the year following sowing down. All crops receive 1¼cwt. of superphosphate per acre at sowing.

Sheep and Cattle Grazing

Sheep and cattle grazing is carried on on soil groups 7 to 11. On much of this land in the higher altitudes of the county misty and showery weather is experienced, and these adverse conditions, a lack of lime and phosphate, and poor pastures make fattening of stock difficult to the extent that most farmers sell store stock.

Much of this land had once been ploughed and sown to grass, but it reverted to browntop mainly, and over considerable areas gorse has taken control. One of the reasons for the failure and abandonment of some farms was that the holdings were too small.

A small run on this country with steep, broken, and undulating areas is one of 3000 acres carrying 2033 ewes, 716 hoggets, 95 wether hoggets, 113 wethers, and 45 Romney rams. Lambing, averaging 84 per cent., starts at the beginning of October. All ewe lambs are retained for replacements and building up of the ewe flock, and culled ewes are usually sold at the Pleasant Point ewe fair, but as development proceeds and a larger area is sown down to pasture the normal seasonal cull ewes will have to be kept for an extra year, thereby increasing the number of ewe lambs for building up the flock. All wether lambs are sold fat off rape and grass.

An attempt is being made to convert the property from typically store sheep country to fat lamb country and during the early stages of development understocking will be preferred to achieving maximum carrying capacity.

There are 156 black polled breeding cows, 25 heifers, and 5 bulls. Calving begins about the beginning of September and all calves are sold the following May. No supplementary feed is given except during winter snow storms, when hay is fed until the ground clears.

The altitude varies from 1200 to 2000ft.; on the lower areas browntop is dense and dominates the sward, but higher there is a patchy moss and browntop sward.

Since development was begun 3 years ago nearly 400 acres of new grass has been established. The programme entailed the ploughing of 100 acres of browntop during May after the gorse had been rooted out and swept into gullies to be burnt. In spring the area was rolled to allow the bulk spreading of 1½ tons of lime per acre before preparation for sowing to turnips and chou moellier and swedes and chou moellier. The area was ploughed and rolled the following spring, when a further 1¼ tons of lime per acre was applied before the sowing of rape and grass. Though such a programme was achieving its purpose of providing improved pasture, the rate of improvement was slow in comparison with the size of the property. Therefore a new policy —contracting to grow approximately 300 acres of linseed annually—has been adopted. The rotation to be adopted is as follows:—

Grass (300 acres)—linseed and grass (50 acres) and linseed (250 acres)—turnips and grass (50 acres), rape and grass (100 acres), turnips (100 acres). New grass follows the 100 acres of turnips.

Grass will be ploughed (with skimmers attached to the plough) by early June, left to lie all winter, and disced and rolled in spring before the final working to allow 1 ton of lime per acre to be applied and worked before sowing of the linseed in October. An initial application of 3 tons of lime per acre will be applied to the linseed and grass area. Subsequent ploughing after harvest will be completed by the end of May if possible in preparation for the spring-sown crop. In spring a discing, harrowing, and rolling, to allow a further 1½ tons of lime per acre to be applied, and then a harrowing will be sufficient to prepare a seed-bed. Turnips will be sown with 3cwt. of reverted superphosphate per acre, other crops receiving 1 to 2cwt. of superphosphate per acre.

The expenses involved in sowing such a large area to grass will be met partly by the saving of 20 acres of Certified perennial ryegrass and 20 acres of white clover annually for seed.

When new pasture is sown the grass will be drilled and the clovers broadcast with 2lb. of rape or a few ounces of turnips per acre. The mixture, a fairly heavy seeding, will be 30lb. of perennial ryegrass, 10lb. of short-rotation ryegrass, 2lb. of white clover, 2lb. of crested dogstail, 4lb. of Montgomery red clover, and 5lb. of cocksfoot per acre. Grass will receive 1 ton of lime per acre every 3 or 4 years as a maintenance ration and gradually a bigger area will be topdressed with superphosphate.

The regular feeding out of hay is a feature of farm practice and at present 30 acres are cut for hay each year.

Gorse has taken possession in many gullies and to control it trees will be planted eventually. These trees will also give much-desired shelter.

Though the course adopted involves much work and expense, the following figures give an indication of the increased production of wool from the property for the short time the programme has been operating and of potential productivity. In 3 years yields of wool rose from 6.4lb. to 7.5lb. and finally to 8.01lb. per sheep and from 4.3lb. to 5.8lb. and finally 6.8lb. per acre.

Dairy Farming and Cropping

Dairy farming and cropping are carried on on soil groups 3 and 4. Dairy farm practices differ from complete dairy farming for town and factory supply to a more typical association of cows and crop. Around Timaru town-milk supply dominates farm practice, but further out, factory supply is general. Drainage has had some bearing on farm practice, as along the coast, north of Timaru particularly, deep drains have been formed and make possible the cropping of areas formerly devoted to dairy farming.

The soils can be cultivated readily, but in winter ploughing must be completed early or soil conditions make it impossible. As much of this land is subject to flooding, autumn sowing of crops and grass is risky and spring sowing is usual, particularly on soil group 4. Barley is a satisfactory spring crop and yields of 75 bushels per acre are common.

Stall feeding of stock is not common; usually hay is fed out and cows are turned on to breaks of chou moellier or chou moellier and swedes. Frequently young stock are grazed out until they come into the herd. Replacements are bred on both town-milk and factory-supply farms.

Frequently oats and peas are sown in spring for hay, mainly after barley, to supplement pasture hay; a great bulk of feed per acre is obtained. Under favourable conditions seed crops of ryegrass and clover may be taken.

Further Development Possible

The change in Levels County in 100 years from virtually one large sheep station to a district of 800 farm holdings producing considerable quantities of meat, cereals, and pasture seeds represents a considerable achievement, but in some areas further changes can occur. Irrigation can be employed to a greater extent, more use can be made of subterranean clover in some areas, and on portions of the more difficult hill country some modification of the present practice of raising store sheep and some fat lambs is likely.

Acknowledgment

The assistance of farmers who gave historical information about their farms to W. Vance of the Department of Internal Affairs and of E. Cutler, Soil Bureau, Department of Scientific and Industrial Research, Timaru, for the information contained in the section on soils is acknowledged.

Radio Broadcasts

RADIO broadcasts to farmers will be given as follows during July:—

1YA Auckland, 7.15 p.m.

2 July—"A Review of the Developments in Aerial Topdressing", by M. M. Burns, Auckland.

9 July—"Winter and Early-spring Feeding of Stock", by G. B. Haddow, Assistant Instructor in Agriculture, Department of Agriculture, Auckland.

16 July—"Seasonal Stock Problems", by I. G. Watt, Veterinarian, Department of Agriculture, Auckland.

23 July—"Grass-grub Control", by J. E. Bell, Fields Superintendent, Department of Agriculture, Auckland.

30 July—Y.F.C. session, conducted by chairman, Auckland Council of the Federation of Young Farmers' Clubs.

1XH Hamilton, 12.33 p.m.

3 July—"Calf Diseases", by P. J. McCann, Veterinarian, Department of Agriculture, Hamilton.

10 July—"The Responsibilities of the Young Farmer", talk organised by the Waikato district committee of the Federation of Young Farmers' Clubs.

17 July—"Collection of Milk by Tanker", by G. Purvis, Superintendent of Butter Instruction, Department of Agriculture, Hamilton.

24 July—"Soil and Man", by J. Shine, Dairy Section, Federated Farmers, Hamilton.

31 July—"Renewing the Household Poultry Flock", by W. L. McIver, Poultry Instructor, Department of Agriculture, Hamilton.

1YZ Rotorua, 7.15 p.m.

10 July—"The Calving Cow", by D. W. Caldwell, Veterinarian, Department of Agriculture, Hamilton.

24 July—"Silage in the Bay of Plenty", by S. R. Hewitt, Assistant Instructor in Agriculture, Department of Agriculture, Whakatane.

3YA Christchurch

10 July (7.15 p.m.)—Review of "The New Zealand Journal of Agriculture", by E. G. Smith, Fields Instructor, Department of Agriculture, Rangiora.

17 July (7.15 p.m.)—"Irrigation in the Ashburton County", by W. McKellar, Fields Instructor, Department of Agriculture, Ashburton.

28 July (12.20 p.m.)—Talk by Field Officer in Rural Sociology, Department of Agriculture, Christchurch.

4YA Dunedin, 7.20 p.m.

2 July—"Sheep Nutrition and Management during the Pre-lambing Period in North Otago", by E. A. Pratt, Veterinarian, Department of Agriculture, Oamaru.

16 July—"Disease Control of Fruit Trees", by W. S. Kemp, Horticultural Instructor, Department of Agriculture, Alexandra.

30 July—"The Work of the Rural Sociologist", by M. B. Strain, Field Officer in Rural Sociology, Department of Agriculture, Dunedin.

Other Broadcasts

1YA Auckland, Tuesdays at 12.35 p.m. and Wednesdays at 7.15 p.m.; 1YD Auckland, Thursdays at 7.30 p.m.; 1XN Whangarei, Mondays and Wednesdays at 8.10 p.m.; 2XA Wanganui, Thursdays at 8 p.m.; 2XG Gisborne, Tuesdays at 8 p.m.; 3XC Timaru, Wednesdays at 8.5 p.m.

METEOROLOGICAL RECORDS FOR APRIL

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	60.6	— 0.5	76.0	43.8	2.37	11	— 3.23	0.58	28	132.0
Auckland	160	61.6	+ 0.3	74.3	48.2	2.29	14	— 2.10	0.58	20	95.9
Tauranga	10	59.4	+ 0.9	74.3	42.2	2.74	10	— 2.28	1.04	25	189.4
Ruakura	131	56.6	+ 0.0	71.7	35.4	2.51	13	— 1.23	0.69	20	122.0
Rotorua	969	57.0	+ 1.6	75.2	37.0	2.55	9	— 2.98	1.08	30	159.2
Gisborne	12	58.2	— 0.2	80.3	40.2	1.04	16	— 2.62	0.32	25	168.7
New Plymouth ..	160	57.4	— 0.7	67.5	43.8	4.24	11	— 0.54	1.43	20	134.4
Napier	5	59.8	+ 1.4	81.1	42.4	2.04	9	— 0.59	1.22	24	169.6
Karioi	2125	51.0	+ 0.6	66.0	30.0	3.81	12	— 0.12	1.26	20	151.3
Wanganui	72	58.0	+ 0.5	73.1	38.7	2.68	11	— 0.01	1.01	28	
Palmerston North .	110	57.2	+ 0.6	71.0	39.4	2.83	9	— 0.53	1.00	20	119.8
Waingawa	350	55.9	+ 1.4	74.8	36.9	2.58	11	— 0.32	1.00	25	162.4
Wellington	415	56.4	+ 0.3	69.2	42.6	2.99	8	— 0.82	0.80	25	144.4
Nelson	5	54.6	+ 0.5	72.4	37.0	2.30	9	— 0.65	0.61	30	186.9
Blenheim	12	55.4	— 0.6	73.8	37.2	1.27	6	— 0.77	0.64	30	208.7
Hokitika	12	53.3	+ 0.4	65.9	36.8	8.09	16	— 0.74	1.72	19	128.6
Hanmer	1225	52.8	+ 1.3	81.2	32.0	1.78	8	— 1.56	0.88	30	179.9
Christchurch ..	22	54.6	+ 1.1	80.5	37.1	0.83	9	— 1.02	0.41	21	170.2
Ashburton	323	55.1	+ 2.5	86.8	33.2	0.72	5	— 1.69	0.29	21	179.8
Timaru	56	53.0	+ 0.0	78.0	35.0	0.63	5	— 1.03	0.50	21	165.8
Alexandra	520	50.8	— 0.3	76.4	26.9	0.82	10	— 0.53	0.20	30	169.6
Taieri	80	51.6	+ 0.3	82.0	26.7	1.16	11	— 0.94	0.36	18	178.3
Invercargill ..	32	52.0	+ 0.2	74.0	28.0	2.82	15	— 1.03	0.63	3	135.9

HEADING PHOTOGRAPH: Dr. C. P. McMeekan, Superintendent, Animal Research Station, Ruakura, addressing a gathering at a field day at the Station.

Ruakura Farmers' Conference Week

GREATLY increased attendances at both field days and formal conference sessions of the fourth annual Ruakura Farmers' Conference Week in Hamilton during May marked it as the most successful yet held.

THERE appears to be increasing appreciation of the fact that the conference is an opportunity for farmers from any part of New Zealand to meet and discuss with agricultural scientists their own particular problems. As the chairman of the conference, Dr. C. P. McMeekan, Superintendent of the Department of Agriculture's Ruakura Animal Research Station, stressed, the Station, subject only to the limitations of the great range of conditions throughout New Zealand, attempts to deal with animal husbandry research on a national scale.

With the limited amount of finance and number of skilled staff available, it was better that one station well equipped and with a high-quality scientific and technical staff should do the research work so important to the animal industry than that such limited strength should be dissipated in an attempt to give a more local service to farmers. The establishment of the Soil Research Station at Rukuhia with its soil-testing laboratory at Galloway adjacent to Ruakura had enabled close integration and maximum effectiveness of research work.

Largest attendances of the conference were at the field day at the Ruakura Station, when over 800 divided their interest between sheep-farming and dairy-farming projects. Formal sessions at which papers are given and then opened for discussion have hitherto drawn more support with dairy-farming subjects than have those dealing with sheep farming or meat production, but interest in sheep was this year markedly increased. Attendances at discussions of papers and at open forums in the evenings ranged up to 700.

Apart from a large number of farmers and others with agricultural interests who came as individuals from far afield, the conference was attended by a party of Northland farmers and by Young Farmers' Federation members from a number of districts. Appreciation of the opportunity to see and hear of the progress of animal research and to discuss their problems was expressed at the end of the conference by representatives of Federated Farmers, the Y.F.C. organisation, and the Northland visitors.

Printed proceedings of the conference (papers and discussions) will later be sent to all who paid the conference fee. Publication will be announced in the "Journal" and extra copies will be available from the Department of Agriculture and the Ruakura Animal Research Station at 10s. per copy.

Pastures

The tendency for inferior grasses to invade fat-lamb and dairy pastures was discussed after an early paper by Mr. E. Bruce Levy. Oversowing with good strains of white clover and ploughing up and resowing were advocated by Mr. Levy, but unsuccessful use of both methods was cited by farmers. Ratstail and barley grass were the chief undesirables.

Opinion was fairly divided on paspalum. It was described by Mr. Levy as "one of the great pioneers of this country, in the same way as browntop has been". One of the main objections to paspalum was its lateness in coming away in spring, and it would be dangerous to include it in a general pasture mixture, especially for fat-lamb production. Farmer opinion that a paspalum pasture was safe during threats of facial eczema was not supported by research evidence. Some of the worst facial eczema had occurred on paspalum-dominant pastures, probably because of the ryegrass that is usually present.

The place of short-rotation ryegrass in Auckland pastures, Rukuhia topdressing experiments, the danger of grazing too soon after topdressing with North African phosphates, and rationed rotational grazing with use of the electric fence were subjects that yielded a crop of questions after the delivery of pertinent papers.

Bloat

The method of grazing for bloat control being used with the Massey Agricultural College dairy herd was explained by Mr. P. D. Sears. He and officers of the Department of Agriculture were introducing it with marked success on a number of farms in the Manawatu. There was keen discussion of his paper.

Increased Meat Production

Several papers dealt with increased meat production by increasing carrying capacity and improving management methods, and also by prevention of losses through better husbandry and veterinary attention. An open forum on "How Beef Output Can be Increased" was preceded by addresses by a meat industry specialist, a farmer, and a research worker. In subsequent discussion political and financial considerations appeared to be given more weight than questions a research worker could answer.

Artificial Insemination

Discussion after a paper on progress in 8 Waikato dairy herds after 8 years of artificial insemination reflected the great interest that has developed in A.I. work since its extension from a research project at Ruakura to a commercial basis through the New Zealand Dairy Board. Data were presented showing the increase in production that could be expected with the use of merit bulls. Unfortunately there are not enough of these bulls to permit their wide use in grade herds. Attention has been devoted to the use of carefully selected sons of merit sires. New Zealand Dairy Board data indicate that these bulls are considerably better than a number of sires used in the industry and their use in A.I. should enable them to be proved, thus increasing the number of merit sires available.

Identical Twins

Development of identical twin projects at Ruakura is providing research results that are of interest and value to dairymen all over the world. It is possible to investigate how much production ability is due to inheritance and how much to the way stock are fed and handled.

It has been found with bulls that poor rearing in early life weakens fertility that high condition rather than low condition gives better results; that excessive use of bulls as yearlings has a deleterious effect on their subsequent usefulness.

It is now possible to put a figure on the cash value of rearing young stock well as opposed to rearing them poorly. The difficulty of getting well-reared yearlings in calf during the early stages of investigations has been eliminated by a modification in technique at Ruakura and well-reared calves now conceive as readily as those on a lower plane of rearing.

Milking Machines and Methods

Papers bringing up to date research into the cleaning of milking machines and the provision of a testing service by Dairy Division officers stimulated searching questions on detergents, quality of rubberware, and standardisation of essential milking components of machines. Loss in production through inefficient milking methods was put by research workers at a fairly high figure. Production of the Ruakura relief valve and milk flow indicator and investigation into cleaning methods and rubberware quality have already contributed much to increased efficiency and hygiene. Main lines of inquiry in future would be into the vacuum pump and releaser. A field survey had shown 70 per cent. of pumps to be inefficient and that they became so fairly quickly.

Farm Shelter and Timber

The effect of depleted timber resources in raising farm costs is obviously becoming a question of keen interest to farmers, and a paper on eucalypts for timber and shelter was discussed as eagerly as any at the conference. Many questioners sought advice on species for particular purposes and locations and some impressive figures of returns from plantations were quoted.—*G.J.N.*

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SHEEP-SHEARING SHEDS AND YARDS—Correspondent J. A. FERGUSON failed to supply his address. Would he please write again.—Editor.

Non-spill Troughs for Chick Food

THE ideal container for chick food on a poultry farm is a shallow trough which is easily accessible to the birds but does not allow wastage and fouling of the mash. Open troughs are unsuitable, and well-designed equipment may be considered too expensive to warrant its purchase, but in this article J. H. Jones, Poultry Instructor, Department of Agriculture, Christchurch, gives instructions for making simple but effective troughs on the farm.

A NUMBER of methods are used to try to prevent waste of chick food. The trough may be fitted with a metal cover having small apertures through which the chicks feed, the holes varying in size with the ages of the birds; though efficient, the cover reduces the feeding space available and a longer trough is required. Another method is to fit a grid of ½in.-mesh wire netting inside the trough and resting on the mash. Both these methods increase the labour of feeding the chicks, as the cover or grid must be removed for the troughs to be filled.

The use of a spinner to prevent chicks from getting into the trough has been well tried. The efficiency of such a trough depends largely on the design and size of the spinner in relation to the size of the trough and also on the size of trough in relation to the size of chicks.

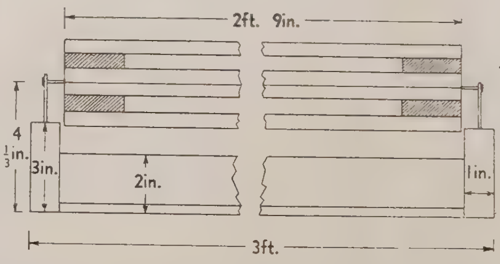
The critical measurement in such a trough has been found to be that between the edge of the spinner and the edge of the trough, provided the trough is of a suitable size for the chicks. Three sizes of troughs have been found effective for birds of different ages—from a day old to 3 weeks, from 3 weeks to 3 months, and from 3 months to maturity. Two troughs of the same size are required for each 100 chicks.

The smallest trough has outside measurements of 3ft. x 5¼in. x 2in. deep. It is best made of ⅝in. timber with the exception of the ends, which are of 1in. timber 5¼in. x 3in. A spinner 2in. square is fixed to the trough by a screw in the centre of each end which passes through an eye screwed into the top edge of the end of the trough. It consists of four ⅝in.-square strips 2ft. 9in. long let into end blocks which are 2in. cubes. Only the length is varied for a spinner for any of the three sizes of trough.

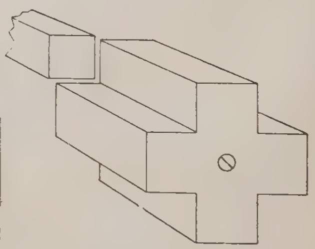
Such a trough may be made entirely of wood or of sheet metal with wooden ends, in which case a lip of ⅝in. should be made to cover the thickness of the wood. The metal trough gives greater capacity for the same over-all measurements because the metal is much thinner than timber.

For chicks from 3 weeks to 3 months old a trough requires to be 3ft. x 5¼in. x 3¾in. in outside measurements, the ends being 5¼in. x 4¼in. Adjustable legs of the type illustrated have been found useful; they consist of two pieces of 2in. x 1in. timber 9in. long secured to the end of the trough by a bolt and wing nut, with a spring washer to prevent their slipping. The height of the trough can be adjusted as the birds grow.

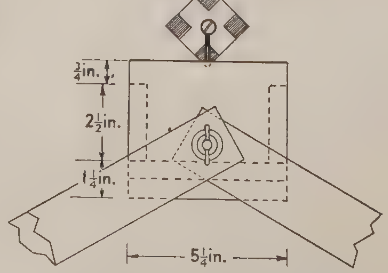
Measurements for the largest size of trough are 6ft. x 8¼in. x 4½in. This trough is used with a simple stand such as that illustrated.



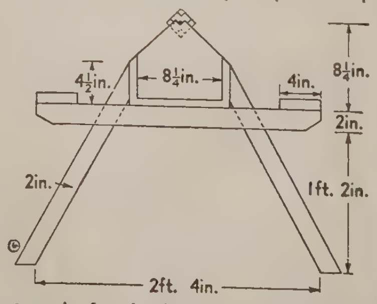
Dimensions of the smallest size of food trough, suitable for chicks from 1 day to 3 weeks old. It is 5¼in. wide.



An end piece of a spinner, cut from a 2in. block of wood into which are let ⅝in.-square strips.



A trough for birds from 3 weeks to 3 months old. The trough, which has adjustable legs, is 3ft. long and the spinner is 2ft. 9in. long.



A trough for birds from 3 months old onward. It is 6ft. long, carries a spinner 5ft. 9in. long, and is supported on a simple stand such as that illustrated.

Rickets in Hoggets in Winter

By J. MULLINS, Veterinarian, Department of Agriculture, Masterton

RICKETS or "Rachitis" is an affection of young animals, in which the ends of the long bones, which at birth and during the early part of life are relatively soft, do not become ossified; that is, hardened to normal bony texture. In some instances in young sheep this is due to factors described in this article, and the results are well shown in the knock-kneed appearance of the hogget in the illustration at the right.

THE disease is characterised by debility, bone weakness, and deformity. Stiffness, stumbling, and lameness are the outstanding symptoms in advanced or clinical cases. The cause may not always be obvious, but the trouble is known to occur under certain conditions. A number of factors may be involved. Rickets in hoggets in this country occurs mostly in southern latitudes and in winter only.

Adequate vitamin D, calcium, and phosphorus are necessary for the laying down of sound bone. Vitamin D is essential for the utilisation of calcium and phosphorus. It has been recognised for some time that a green cereal such as green oats, unless balanced by old pasture or hay, frequently produces rickets in hoggets. Immature rape occasionally has this effect also. A ricket-producing factor, possibly an anti-vitamin D factor, exists in green cereal.

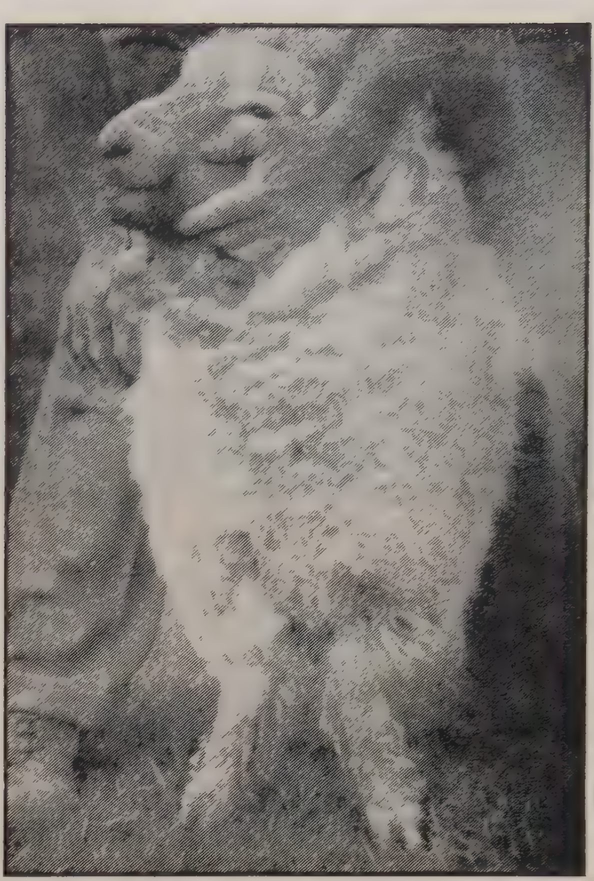
Latterly, however, clinical rickets has been observed to occur in hoggets in winter, on old pasture only, in the Wairarapa and Southern Hawkes Bay districts of the North Island. This unprecedented or unrecorded aspect or hazard of sheep raising in New Zealand was spectacularly manifested last winter on at least two sheep farms in that area. These properties are situated on good sheep country—hills and alluvial flats. The flats were reserved for stud ram lambs. It was here that they wintered and in these lots the disease began to appear in June. Up to a few years ago no abnormal difficulty was experienced in rearing lambs or successfully carrying them through the winter here. The ewe and wether hoggets on the hill country wintered without any trouble.

Over the past few winters a progressive unthriftiness and stiffness became increasingly evident in the stock on these flats, until in 1951 the climax came. Close on 100 per cent. of the stock was affected in varying degrees, the symptoms being those of clinical rickets. The bones and joints, notably those of the fore limbs and lower jaw, showed a very apparent deformity in many cases. Where the lower jaw was involved the mouth could not be properly closed. Some of the stock worst affected went down and were unable to rise. As is the case in rickets blood samples taken from a number of the hoggets were found to be low in calcium and phosphorus. Post-mortem examination of animals showed that the bones and joints were typical of this disease in their low mineral content, weakness, and deformity.

Investigation of Trouble

When first seen in late winter, in the investigation of the trouble, the hoggets were in a bad state, but in the few weeks that they were under observation most of them were beginning to show an improvement as spring advanced. This was in line with what is normally observed when rickets occur on accepted ricket-producing feed. Mortality in the affected lots was low, but the over-all loss was considerable, as many of the hoggets could never become profitable sheep.

The disease having been diagnosed and confirmed as rickets, the owners were advised to dose the hoggets with calciferol, which is a preparation containing concentrated vitamin D. The results of the treatment were good and hastened recovery in cases for which there was reasonable hope. More favourable climatic conditions no doubt assisted in the cure, for about that time, the end of August to early September, there was more sunshine and the sun's rays were becoming more direct, enabling the hogget to synthesise vitamin D in its body by solar irradiation, thus promoting repair of defective bones and improving the health and condition of the animal.



The forelegs of a rickety hogget.

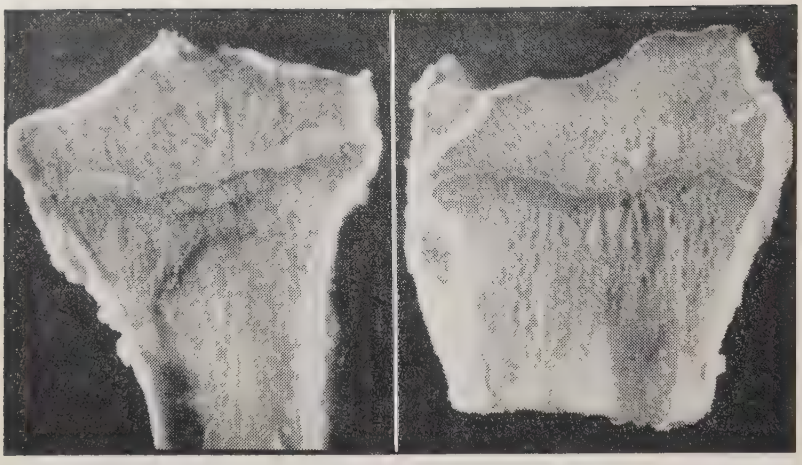
Soil and Pasture Conditions

The calcium and phosphorus content of the soil in the area was found to be within satisfactory limits, but the cobalt content of a liver from one of the hoggets was low. Deficiency of cobalt, while no doubt aggravating the position, was not responsible for the development of rickets. The pastures were laid down about 50 years ago and are composed mainly of mixed English grasses and clover. The owner of one affected property topdresses fairly regularly with lime and superphosphate; the other does not topdress at all. There was no perceptible difference in the incidence or severity of the disease on the two farms. Hay or other supplementary feed was not given at any time.

The fact that rickets occurred on old pasture and on these flats only stimulates conjecture. It is common knowledge that sheep, especially lambs, do not thrive when the hours of sunshine in summer are not good; also that lambs winter much better after a good sunny summer, even under hard conditions. The sun's rays, via the skin, are an important source of vitamin D, which is so essential for sound bone formation and good constitution in the young growing animal. In a relatively sunless summer, like that of 1951-52, the conditions are unfavourable for body synthesis of vitamin D, so that at the approach of winter in such a season bone formation may be unsatisfactory and body reserves of vitamin D below normal. These conditions place the lamb at a grave disadvantage for the critical period immediately ahead.

Influence of Climate

The quality and suitability of the feed are of course also influenced by climatic conditions. Lambs do not thrive



Leg bones of hoggets cut lengthways. Left—From a rickety hogget. Right—From a normal hogget.

on soft, wet feed at any time and heavy dairy country in a wet season is particularly unsuitable for lambs and hoggets. Recent experiences make such conditions suspect at least of predisposing to rickets in winter. Excess moisture and lack of fibre and mineral make pasture on such country unpalatable and of little use for lambs. Nitrogenous immature greenfeed such as that following autumn topdressing in any type of country in winter may also produce rickets in hoggets. A week or two of such feed on a sunny hill face produced rickets in ram hoggets last June. Recovery followed removal to hard untopdressed hill country.

Vitamin B the Critical Factor

It might be postulated that, as well as green cereals, nitrogenous immature greenfeed, dairy pasture of high water content, low summer sunshine hours and high rainfall singly or in combination predispose to or may be responsible for the development of rickets, clinical or sub-clinical, in hoggets in winter. Vitamin D seems to be the critical factor in this disease in New Zealand. The farmer, therefore, is advised to dose his lambs with calciferol at the onset of winter to prevent rickets developing. A second dose may be necessary about July. Calciferol supplies the vitamin D in which the growing lamb may be deficient. The vitamin D requirements of the young animal are probably governed by its rate of growth. In winter on country where a deficiency of this vitamin may exist forcing feed or stimulating greenfeed may be dangerous for hoggets. Owners of rickety hoggets have found that early-spring shearing hastens recovery.

Internal Parasites

Internal parasites are not responsible for rickets, though their presence might predispose an animal to the disease. Popular estimates of the extent of infestation with internal parasites are probably too high. There is no veterinary support for the opinion that internal parasites are invariably the primary and principal cause of winter hogget mortality and that worm drenches are always the answer. The continuance of high losses, in spite of the widespread use of approved drenches to control internal parasites, suggests that it might be wise to seek the cause of the trouble elsewhere. The possibility of sub-clinical rickets playing a hitherto unsuspected part must be entertained, and this is tentatively supported by the findings following a limited investigation last winter into serious losses on a sheep farm that had previously been used for dairying.

Good hay is a fair source of vitamin D, as well as having a general beneficial balancing effect on winter pasture and green crop. Where hoggets are educated to eat it freely during winter the risk of rickets is minimised.

Pasture and Crop Seeds

THE Department of Agriculture is responsible for multiplying under contract nucleus lots of the major agricultural seeds, most of which are produced by the Department of Scientific and Industrial Research, though some are maintained by the Department of Agriculture. The seed produced under contract is distributed into the seed-growing areas, where it is multiplied for from one to three generations under the control of the scheme of seed certification operated by the Department of Agriculture.

DURING these multiplying steps the various grades of seed are marketed through the usual commercial channels, but the production of that seed must comply with a prescribed procedure if the seed is to be recognised as certified.

Contract Growing of Seeds

The following quantities produced under contract were distributed to growers during 1951:—

	bus.
Perennial ryegrass	2,093
Italian ryegrass	757
Short-rotation ryegrass	1,693
	lb.
Timothy	894
White clover	9,257
Montgomery red clover	1,724
Cowgrass	2,532
Lucerne	1,633
Rape:	
Broad Leaf Essex	2,420
Giant	405
Club Root Resistant	1,723
Chou moellier:	
Giant	615
Medium Stemmed	907
	bus.
Oats:	
Abundance	1,058
Dun	402
Achilles	360
Barley:	
Wong	565
Cape	630
Mid-season Research	258
Wheat (Yielder)	804
Ryecorn (N.I.A.B.)	730
Peas:	
William Massey	435
Onward	425
Greenfeast	387

Contract areas are being maintained to produce somewhat similar quantities during 1952.

Seed Certification

The quantities of seed certified in 1950 and 1951 respectively are given in the following table:—

	1950	1951
	bus.	bus.
Perennial ryegrass	581,482	2,084,212
Italian ryegrass	23,530	96,398
Short-rotation ryegrass	118,131	222,763
	lb.	lb.
Cocksfoot	276,748	474,123
Browntop	356,045	534,197
Timothy	42,387	53,843
Phalaris tuberosa	3,661	2,820
White clover	2,901,099	4,139,375
Cowgrass	776,319	644,497
Montgomery red clover	435,663	368,386
Subterranean clover	15,635	16,880
Lucerne	23,773	39,858
	cwt.	cwt.
Linen flax	1,403	—
	lb.	lb.
Onion	8,511	3,172
	bus.	bus.
Wheat	110,820	90,940
Oats	6,974	7,373
Barley	12,092	8,834
Maize	1,749	858
Sweet blue lupin	—	243
	lb.	lb.
Rape	317,556	727,239
Chou moellier	100,617	24,113
*Kale	8,951	66,769
*Turnip	183,647	18,119
*Swede	—	25,915
	tons	tons
Seed potatoes	8,233	7,154

* This seed is termed Government Approved.

For the major grass and clover seed items this table reflects the trend of seed production generally, but for most of the crop seeds the quantities certified are governed by requirements and in some cases they also include considerable carry-over stocks from a previous harvest.

—*J. H. CLARIDGE,*
Superintendent, Seed Industry,
Department of Agriculture,
Wellington

Honey Bees and Pollination of Orchard Fruits

["*Weekly News*" photo.

FRUIT GROWERS generally are fully aware of the importance to the setting of profitable fruit crops of satisfactory pollination and fertilisation of the blossom. For full production of fruit most fruit trees grown commercially in New Zealand require the service of insects for proper distribution of pollen, and the honey bee, because of its habits, bodily structure, and complete dependence for its existence upon the two plant products pollen and nectar, is the most efficient and dependable of all pollinating insects. In this article D. Roberts, Apiary Instructor, Department of Agriculture, Auckland, explains the requirements necessary for maximum pollination by honey bees.

FLOWERS in early spring are visited by far more honey bees (*Apis mellifica*) than any other insect. Intensive cultivation, rotational cropping, close pasture grazing, and the clearing of bush and scrub lands have so diminished the numbers of wild pollinating insects that in most areas they are now a negligible factor in the pollination of deciduous fruit trees. As experiment has shown that little fertilisation of fruit blossom is brought about by wind, sufficient insects to effect efficient pollination are essential if profitable fruit crops are to be harvested.

With the decline in the numbers of wild pollinators the honey bee has become of increasingly greater importance to fruit growers, and the value of its work in this connection is many times that of the honey and wax produced. The honey bee, though not domesticated in the sense that cattle, poultry, and some other creatures are, is managed and kept in all countries where plant growth will provide its support. It is the only pollinating insect amenable to sufficient control to enable distribution to be made as required.

Because honey bees depend for existence wholly on two plant products, nectar and pollen, their activities are especially suited for fruit pollination. Pollen is most necessary to bee life, for it forms the greater part of the food which is fed in large amounts during the larval stage. The nectar is converted to honey, which is the adult's food.

[*Robertson photo.*
A honey bee with loaded pollen baskets.

In the course of evolution honey bees have developed body structures admirably suited for the efficient collection and transportation of pollen. The whole body is thickly coated with hairs so arranged that pollen grains of all sizes adhere to them. The legs also carry pollen baskets and pollen-manipulating devices. The front legs bear notches of the exact size required for stripping the antennae clean, the middle legs have spines and hair combers, and the hind legs bear spoon-shaped depressions or corbiculae.

When working on blossoms the bee continually cleans its body of pollen grains with the combs on its legs and stores them in the pollen baskets, from which they are removed when the bee returns to the hive. Combing is only partially effective and many pollen grains remain on the bee's body. It is these grains that are important in effecting pollination. When collecting either pollen or nectar bees normally confine their visits to only one species of plant and may visit some hundreds of blossoms before securing a load. Another factor contributing largely to the success of honey bees as orchard pollinators is their ability to produce enormous numbers of workers in early spring, when most other pollinating insects are either dormant or present in comparatively small numbers.

Importance of Strong Colonies

This ability to produce workers largely depends on the shelter and care provided by man. If bees are housed improperly or are supplied with insufficient stores of honey and pollen, they will be of little value to orchardists in early spring. No colony is of any great value for pollination unless it is of sufficient strength to fill at least two hive boxes with brood and bees. In cold, windy weather bees in strong colonies fly much more readily and in far greater numbers than those in weak colonies, as weak colonies need practically all the bees to maintain the hive temperature at a safe level for brood rearing and will be able to supply only few bees for pollinating. Strong, virile colonies are essential for efficient pollination, particularly of plums and peaches, which bloom from August onward and sometimes even earlier. Colonies of bees used for pollination of such early-blossoming fruits will have emerged only recently from the period of winter inactivity, and weak or poorly managed hives may contain no more than 3000 to 5000 bees and little brood. However, strong, well-cared-for colonies should contain up to 30,000 bees and several frames of brood and will need large quantities of pollen. Such colonies have a strong incentive to gather nectar and pollen and will provide effective pollination where three to four times the number of weak, neglected hives would fail. The number of hives needed for good coverage is of course dependent on the acreage of the orchard to be pollinated and the condition of the hives. Distribution of the hives throughout the orchard is governed by the acreage. In areas of up to 5 acres the hives should be grouped in a sheltered spot just within or bordering on the orchard. With larger acreages the bees should be established in more than one position, as in cold and windy weather flight may be limited to a few yards, but the hives should be so arranged that no interference with the normal working of the orchard will occur. If hives of good strength are used, one hive to every acre should provide sufficient pollinators whenever the weather permits the bees to fly.

Other Factors in Pollination

An ample number of pollination insects is essential to full fruit set, but other factors such as favourable weather, the planting of compatible varieties where self-sterile fruits are grown, as mentioned in an article, "Factors Influencing the Setting and Bearing of Fruit Trees", by T. Conway, in the April issue, and the maintenance of healthy trees, free from serious diseases and pests, are also of great importance. The uncertainty of the weather can be met by well-located, powerful colonies, ensuring the maximum possible pollination under unfavourable conditions.

A contrast in hives. Left—A strong hive with a large force of bees suitable for pollination work. Right—A hive inhabited by a weak colony. Such a hive is illegal and useless for good pollination work.

Apples, plums, peaches, nectarines, pears, and apricots, particularly the self-sterile varieties, require the services of insects for pollination. Though certain varieties of trees are capable sometimes of fruiting well without insect assistance, insects are needed if full crops are to be harvested.

Where heavy blooming occurs a bee may confine its activities to an area of only a few yards, and in the case of a large tree to only part of the tree. The necessity to fly to other trees in search of pollen or nectar would be reduced, and with self-sterile trees such as most apple varieties effective pollination would be limited. To overcome this the number of bees must be increased sufficiently to ensure complete coverage. To ensure effective cross pollination orchards with self-sterile varieties require a much greater number of insect pollinators than do those with self-fertile varieties, where every blossom visited is assisted toward pollination.

Though one good hive to every acre of planting generally will provide sufficient pollinators, exceptions may occur, particularly in localities where the weather at blossom time is frequently cold and windy with low light intensity. It would be better under these circumstances to increase the number of hives to two per acre, but where the weather is usually mild and favourable to the flight of bees two hives to every 3 acres should prove adequate.

Competitive Sources of Nectar

Satisfactory orchard pollination by honey bees is governed to some extent by the attractiveness of the nectar of the fruit blossoms compared with that from other sources. The percentage of sugar in the nectar yielded by many fruit trees is low compared with that obtained from willow, manuka, cabbage tree, native fuchsia, barberry, kowhai, buttercup, and some of the eucalypts, which bloom simultaneously with many orchard trees in some areas.

Research by overseas authorities into the sugar concentration of nectar of several varieties of different fruit trees has shown the average concentrations to be approximately as follows:—

	Per cent.
Pears	**4 to 30**
Plums	**10 to 28**
Apricots	**12**
Peaches	**Up to 30**
Apples	**50**

The table shows that some varieties of plums, apricots, peaches, and pears particularly may be affected detrimentally by the presence of competing plants. This difficulty may be overcome partly by increasing the number of hives until it is evident that competition between the bees has forced many of them to gather the less attractive nectar available from fruit bloom. Apples, with their generally higher sugar concentration, are unlikely to be affected much, and where they are grown almost exclusively one good hive to the acre should be ample in all seasons. Over-pollination can occur in apple orchards favourably situated, and much labour is required for thinning the fruit. In such circumstances one strong hive to every 2 acres may be sufficient.

Care of Bees Important

Successful beekeeping demands specialised knowledge and close attention to detail, particularly during spring, and the grower with more than a few acres will not have time to be an efficient orchardist and a good beekeeper too. Bees require considerable skilled attention throughout the year, and only well-managed colonies can produce large numbers of pollinating field bees early enough in spring to be of service to the orchardist. The grower who has insufficient time to study thoroughly beekeeping and disease control will not be able to prepare his colonies successfully for early pollination purposes and may even, through the spread of disease, decimate the bees already in the district. Unless qualified to care for their own hives properly growers will find it advantageous to make arrangements with some competent local beekeeper to supply the hives required for pollination. When seeking the services of a beekeeper it is well to remember that bees are seldom able to store any surplus honey from fruit blossom, and if other good nectar sources blooming later in the season are not within bee range, the beekeeper will be providing the service without hope of reward.

People who keep bees professionally depend upon the production of honey and beeswax for their livelihood and unless hives produce a substantial surplus of saleable honey the beekeeper must operate at a loss. As orchard sites are frequently unsuitable for profitable honey production, it is reasonable to expect in such instances that the beekeeper should be compensated for the valuable service he provides. Where such arrangements can be made the grower should insist that the colonies supplied for pollination are of the necessary strength and quality to perform the required work.

Risk of Spray Poisoning of Bees

Hives located in or near an orchard are always exposed to some danger during the spraying period. The use of arsenical and other insecticidal sprays presents an acute problem, as, although the first spray may not be applied until after complete petal fall, to some extent there is still a danger of bee poisoning where there is any cover crop attractive to honey bees growing in the orchard. Strict observance is necessary of the regulations prohibiting the spraying or dusting of fruit trees with substances injurious to bees until almost all the blossoms have fallen from the trees. To provide maximum protection for honey bees where necessary orchardists should consult officers of the Department or the beekeeper before sowing cover crops.

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Feed Taints in Cream

FEED taints and flavours in milk and cream have an important bearing on the quality of manufactured dairy products and much expensive equipment and costly treatment are necessary to make tainted cream suitable for manufacturing. In the first part of this article W. G. Batt, Supervisor of Farm Dairy Instruction, Department of Agriculture, Hamilton, discusses cream character and feed taints and their effect on manufacture, together with treatment in the farm dairy; in the second part A. V. Allo, Instructor in Agriculture, Department of Agriculture, Tauranga, explains the methods of grazing control and pasture management best suited to checking quality faults in dairy produce.

THERE is a tendency for producers to feel that the installation of modern machinery and the adoption of scientific methods of treating cream by factories will remove all quality faults and make care on the farm unnecessary. However, it is the quality of the raw milk and cream which chiefly determines the quality of the products and it is the responsibility of producers to provide a raw product of the most suitable quality.

Modern machinery and scientific treatment cannot be expected to remove completely all feed taint from an aggregate which is badly affected, nor can the most intensive or extensive treatment deal with individual supplies which are strongly tainted by such feeds as swedes, garlic, or land cress. For this reason, and because the aggregate to which tainted cream might be added would be lowered in quality, dairy factories usually reject as unsuitable for manufacture individual supplies strongly tainted by these feeds.

Because the rate of processing feed-tainted and inferior cream is progressively slower according to the intensity of the foreign flavour, the costs of manufacture are increased considerably and become heavier according to the quantity of inferior cream received. In addition to the slower rate of processing the treatment also requires higher temperatures, which in turn increase the cost of manufacture by a greater consumption of fuel. All of these costs must be borne by the dairy company and any reduction in price received for a lower-quality manufactured product further lowers the aggregate available for distribution and reduces individual payouts. Although the position as it relates to individual suppliers is corrected to some extent by differential payments according to grade of milk or cream, the receipt of poor-quality milk or cream by any dairy company must result in a lower payment to all its producers.

Weaknesses in Cream in Spring

A consideration of feed taints in cream and their effect on dairy products would be incomplete unless it included reference to the changes that take place in the character of cream during the producing season. An understanding of these changes during periods of each season enables producers to take steps to counteract the natural weaknesses which develop.

Due to a number of causes cream produced in spring is quite different in character from that of the main producing months of summer and autumn, and it lacks the full flavour that is associated with sunshine, dry, hard fodders, and a progressive extension of the lactation period.

Cream produced in spring is characteristically weak in body and flavour, frequently is insipid, and usually is much thinner than in summer and autumn, although the fat content may be similar. In addition it usually has a feedy and cowy flavour. By comparison with cream produced later in the season spring cream is basically weak and therefore feed taints and foreign flavours become prominent.

This condition is a natural characteristic, but is accentuated by comparatively wet periods and seasons with a comparative lack of sunshine or by cows being in poor condition or grazing on poor pastures. The general feed taint, even from good pasture, is due to the cows grazing on the flush and succulent growth, and it will prevail until the grasses harden from sunshine and drier conditions. The accompanying "cowiness" is due to the majority of cows being in a heated condition shortly after calving and this flavour is reduced as the lactation period extends. The fats which make up butterfat in cream are also softer in spring and there is a greater percentage of soft fats to hard.

Influence of Soil Type

Undoubtedly soil type also plays a large part in determining the natural or basic flavour of cream. Limestone country is noted for producing cream of good body and full flavour. Light soils usually produce a cream of weaker body and flavour; production from heavier loams and clays has a better body and much fuller and richer flavour. Similarly, cream produced from country newly broken in, especially if the soil is light, will be particularly weak in body and have a watery and insipid flavour. This condition may persist for some years. The incidence of over-all and natural spring feed taint associated with clean pastures comprising the species usually in a dairy pasture can be expected to diminish as pastures become established, but will not be removed completely.

The weaker character, the thinner consistency, the softer fats, and the general feedy and cowy flavour which prevail in early spring are a natural characteristic, and frequently the term "feedy" applied to cream in early spring is more descriptive of lack of character. Nevertheless, butter made from such cream will be weak in body and texture, of a comparatively high colour, and usually will have a feedy and cowy flavour. Such butter generally does not reach Finest standard.

Producers can do much to make their raw produce more suitable for manufacturing by care and attention

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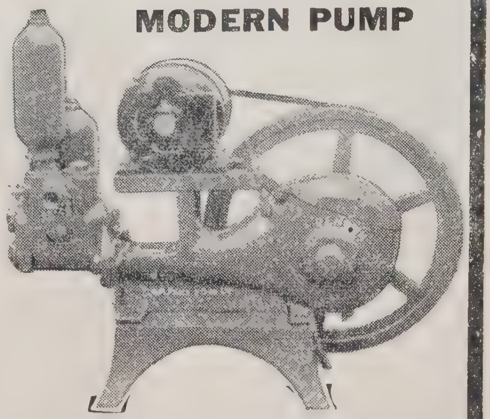

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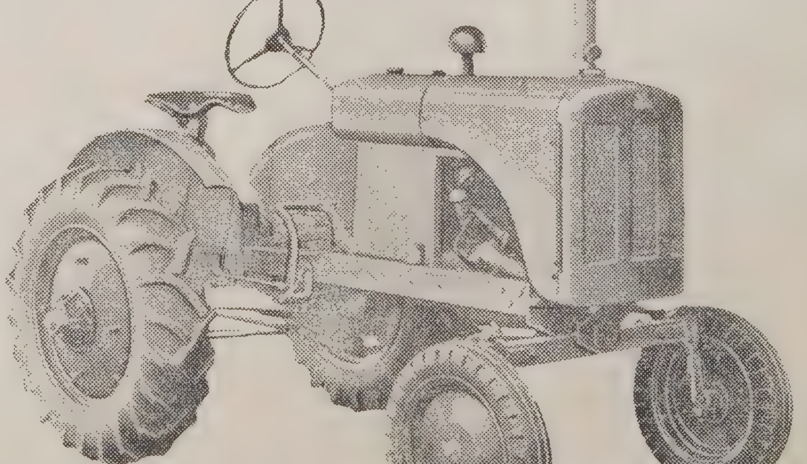

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and by applying remedial measures based on an understanding of the quality faults. First, measures to be applied at the farm dairy will be discussed. Long-term improvement measures in pasture management are suggested later in the article.

Treatment at Farm Dairy

A daily-delivered cream containing 40 per cent. butterfat will be more liquid in spring, due to the softer state of the fats and other constituents. Consequently, it will agitate freely in cans during transport and tend to churn and cause metallic and oily flavours to form. The remedy is to produce a cream of good consistency, 42 to 45 per cent. butterfat, to retard agitation and improve the natural weakness in character.

Lack of the usual full and natural flavour in cream in spring can be offset by preventing water and skimmed milk used in flushing the machines and separator from reaching the milk or cream and by skimming more thickly.

The natural cowy flavour in cream in spring can be reduced considerably by efficient surface cooling in a clean atmosphere and by frequent agitation with a metal plunger to liberate gas. Cooling and aeration of cream in clean air liberates imprisoned gasses, lowers temperatures, and improves consistency.

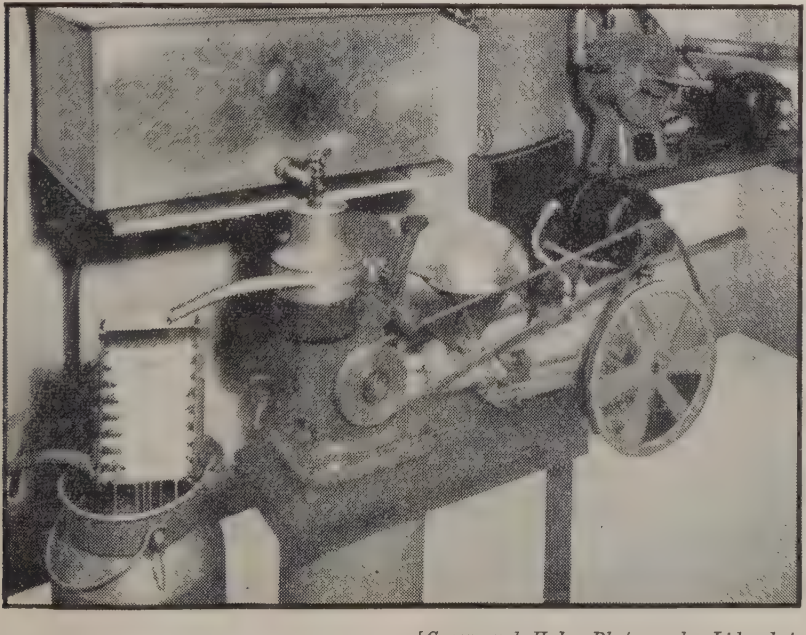
Much of the natural feedy flavour in cream derived from the lush and succulent soft growth of pastures in spring can be removed by efficient cooling and aeration in clean air, combined with frequent plunging.

Importance of Good-bodied Cream

Cream character is of great importance in the manufacture of dairy products. A factory receiving mostly weak cream can do little to improve it and can have little chance of making best-quality butter. Although treatment and processing may remove some feedy or cowy taint from such cream, there remains mainly an insipid liquid containing fat. On the other hand, processing of sound, rich cream of good body to remove feedy and cowy taints leaves a residue that is basically sound and from which good products can be made. The first concern of farmers should be to produce a cream sound in body and rich in flavour. This will be more suitable for treatment and provide a sound base for a good-quality product. Feedy and foreign flavours will be less prominent in such cream, and it is the percentage of rich-quality produce which decides the basic flavour of the output of the factory.

[*National Publicity Studios photo.*

The tendency for cream in spring to churn in cans in transit and to develop oily and metallic flavours can be countered by producing cream of good consistency, 42 to 45 per cent. butterfat, early in the season.



[*Green and Hahn Photography Ltd. photo.*

The natural cowy flavour in cream in spring can be reduced considerably by efficient surface cooling in a clean atmosphere.

Permanent Feed Taints

During late spring, summer, and autumn the nature of cream changes and it attains a better consistency and a fuller and richer flavour than in early spring. The common cowy and feedy flavours are reduced or removed by sunshine and the extended lactation, and the cream, being basically sound, is better able to withstand developing weaknesses and foreign flavours and will make a better butter.

The characteristic feed flavour of spring from flush growth, which can be classed as temporary, is removed by natural conditions, but may develop in individual supplies from herds grazing on pastures recently sown or recently cut for haymaking. Feed taints which can be described as permanent develop from cows grazing or feeding on any taint-producing food. Such flavours will be intense in some cases, depending on the type of food and percentage of non-tainting foods available and consumed. Permanent feed flavours are caused by cows eating feeds with a strong taste or smell. A small quantity of such feeds will produce a characteristic feed flavour at any time of the producing year and it will persist as long as such grazing conditions continue.

Paspalum, cocksfoot, and ryegrass produce good-flavoured cream, but even some of these at certain stages of growth give a feed taint. During the main producing season, however, these grasses give cream of good flavour. All clovers produce strong feed flavour and considerable gas, the extent of both depending on the quantity of other grasses or fodders consumed. *Lotus major* imparts a distinct bitterness and gas to milk and cream.

Intense feed taints arise from uncontrolled feeding of, or grazing of cows on, a large variety of foods with a strong taste and smell such as turnips, cabbage, chou moellier, rape, and watercress, and from cows obtaining quantities of such plants as pennyroyal, *If you switch to*

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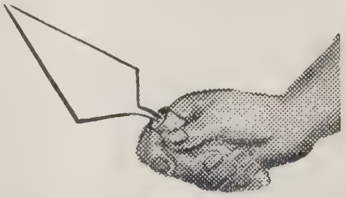

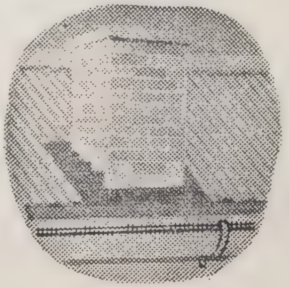

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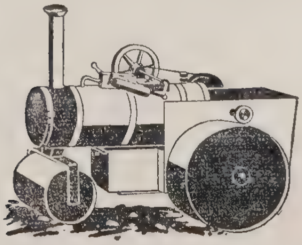

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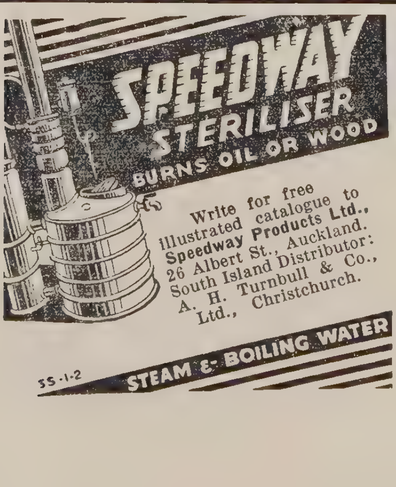

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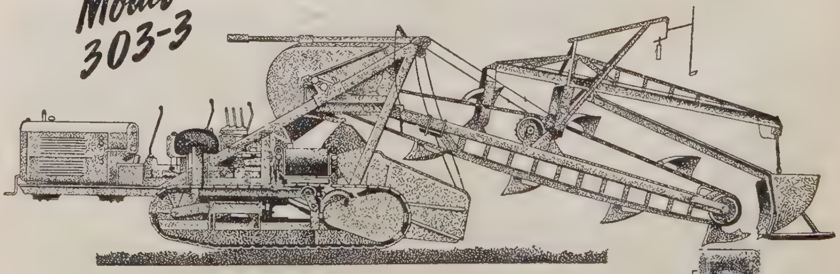

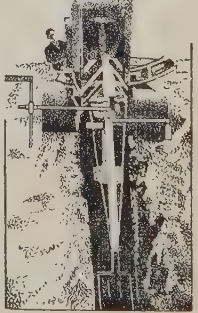

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swedes, and land cress. Feeding of unwilted swedes can also cause intense taint.

Any feed with a strong taste and smell will produce a taint in cream, and the very wide range includes the young shoots of manuka, gum leaves, and musty hay. If cows eat small quantities of garlic from stray patches (frequently on roadsides), it may result in cream from them being rejected by the dairy factory.

A wide range of unsatisfactory feed taints develops from cows grazing in swamp lands and marshy ground. Usually such cream is very bitter and many of the taints are intense and difficult to treat. The trouble occurs mainly during dry spells, when cows are searching for succulent food. During such foraging they consume quantities of strong-tainting weeds and plants. "Slimy" and "ropy" milk and cream are also usually the result of cows grazing on such areas and where water has stagnated. Another unusual and objectionable taint develops from cows eating the short, soft rushes and plants that grow readily in bogs and swamps. The cows uproot the plants when grazing and consume part of the roots and the swamp slime attached, which gives a most objectionable taint.

Where cows are grazed on paddocks of swedes or turnips for some time or consume large quantities of plants such as wild garlic or wild onion, the flesh of the animal is tainted by the flavour of the foods. Meat from stock slaughtered after grazing extensively or exclusively on such feeds is affected by their flavour and smells and tastes strongly of the food consumed. As the imparting of these flavours to milk and cream will persist until the taint is removed from the flesh of the cow, no immediate improvement from grazing control can be expected.

It is probable, too, that some feed taint will be from absorption, and it is likely that a small part at least of land cress taint will enter the system of the cow from a bruising of the plants during grazing. Some absorption of cowy and feedy flavours by milk and cream can occur during milking, through the pungent smell of animals and their discharged breath being drawn into the milking machine.

Usually the presence and extent of feed taints depend on the quantity of tainting foods consumed by the cow in relation to the quantity of non-tainting foods. If cows are grazed exclusively on young grass or extensively on turnips, swedes, or cress-infested pasture, the feed taint will be intense, but if they are given a preponderance of non-tainting foods or grasses, the milk or cream will not be affected.

Serious Feed Taints

The most intense feed taints are set out below in order of seriousness to the manufacturing dairy and according to the difficulty of providing satisfactory processing.

Land cress taint: Because of the serious effect of this taint and its effect on manufacturing, special reference is made to it later in this article.

Garlic taint: No treatment or processing by the factory can remove from cream the intense taint caused by the consumption of a very small amount of garlic and strong consignments are usually rejected. The remedy is to keep cows from infested areas and to destroy any garlic.

Swede taint: Factory treatment cannot remove this taint and strongly flavoured cream of this kind is second-grade quality and will make similar butter. The remedy is judicious feeding of small quantities after milking and distributing the fodder for wilting before consumption.

Turnip taint: The taint from soft turnips is not as strong as that from swedes, but the remedy is the same.

Feed ferment: Cream affected in this manner is intensely bitter and ferments rapidly. It is one of the most costly of creams to treat in the factory and is always second grade. Ferment is caused by a combination of feed taint and the unclean, foreign flavour associated with the bacteria from unclean equipment. Feeds producing gas, such as *Lotus major* and clovers, are the most common causing this taint. The remedy is to remove anything sour from the dairy or equipment, sterilise all plant and utensils, and give cows a greater percentage of harder grasses. Skimming a thick cream will retard fermentation. Efficient cooling of cream and frequent plunging with a metal stirrer will assist in removing the gas which assists in the fermentation of cream.

Lotus major taint: The intense bitterness which arises from cows consuming *Lotus major* in quantity constitutes a serious taint. The remedy is to keep cows from such feed or to ensure that they get only a little of it. A cream of good body should be produced so that the taint can be partly removed by treatment in the factory. Efficient cooling and aeration at the farm dairy should be provided.

Bitter and swamp taints: The remedy for these is controlled grazing, but in the farm dairy the remedial measures of efficient cooling, aeration, and frequent plunging will bring improvement. Cream of good consistency should be skimmed.

Clover taints: Intense clover taint can cause much trouble in manufacturing and the gas which is prevalent in cream produced from feeds of the clover family will assist fermentation if it is associated with the bacteria from unclean equipment or premises. Cooling, aeration, and frequent stirring are essential in the farm treatment, and skimming a thick cream is even more necessary.

Land Cress Taint

Of all feed taints that from land cress is most serious and causes unending trouble at factories in districts where the plant thrives. It is also the most difficult taint to detect and is caused by the mustard oil of the plant tainting the fats of milk and cream. The flavour is harsh and similar to that of mild mustard and becomes more intense as the cream is heated from cold to hot. A mild flavour of cress in cold cream becomes a prominent taint in finished butter. Consignments of cream badly affected with cress taint are unsuitable for manufacturing and factory managers usually return them to producers.

Detection Difficult

The seriousness of cress taint lies in the difficulty of detecting it in cold cream. Feed taints such as those produced by turnips and garlic are serious in themselves, but control of them at the factory is relatively simple. They are quickly and easily detected in cold cream when it arrives at the factory and affected consignments can be segregated for separate and additional treatment, or they can be made up separately into a lower-grade butter or rejected as unfit for use.

All feed taints other than that from cress can be noted easily and quickly on the factory stage and segregation or rejection of the affected consignments can be arranged quickly and conveniently.

The difficulty of detecting cress taint means that there is always the risk of a small consignment passing unnoticed

Dairy herd wintering on swedes. Intense taint arises from uncontrolled grazing on paddocks of swedes, from feeding swedes in too great a quantity in relation to other feeds, or from feeding unwilted swedes.

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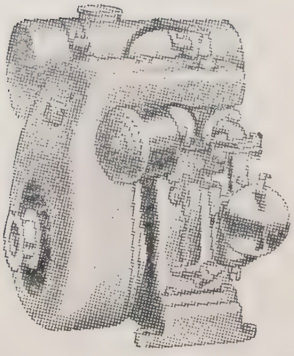

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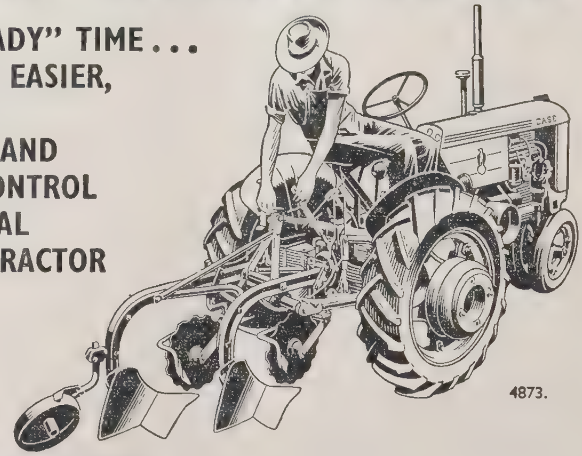

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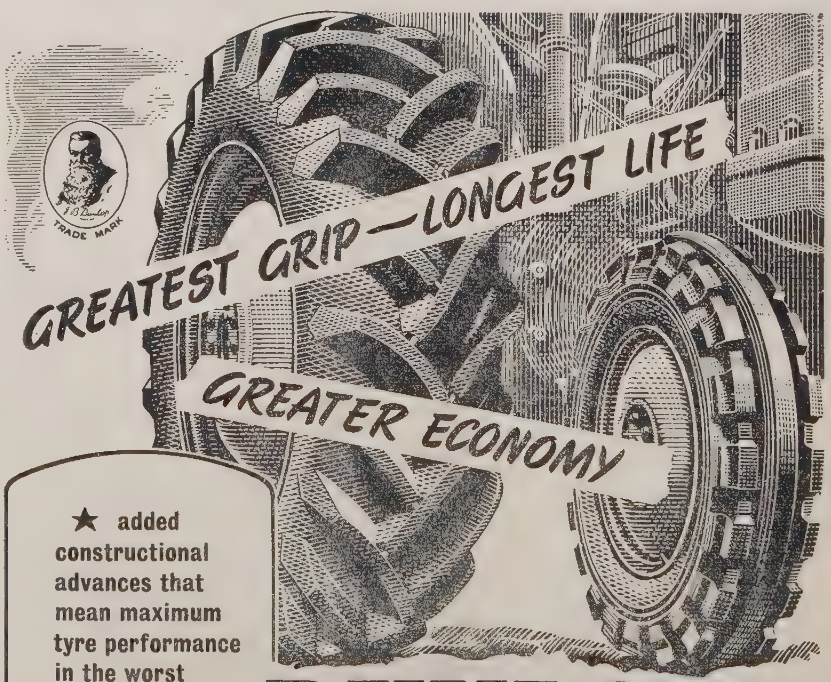

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or the taint appearing insufficiently pronounced in cold cream to warrant segregation, but its inclusion in the aggregated supply is sufficient to lower the grade of butter made from the whole vat of cream with which it is mixed.

Tainted Cream Can Cause Heavy Loss

Cream storage vats in factories are usually of 3000 gallons capacity and this quantity of cream will make approximately 220 boxes or 6 tons of butter. One can of cress-tainted cream inadvertently mixed with this aggregate and lowering the quality or grade of the whole output of butter made from it will cause very heavy losses. A reduction of only a half point in the grading of this butter will mean a loss of 7d. per box under the present system of differential payment according to grade. Should the quality be affected more severely and the grading points be lowered, the loss will be increasingly greater.

To these supplier losses must be added the heavy costs involved in slower treatment, upsetting of the factory routine, and the extra measures of detection that must be taken regularly and periodically. A factory may find that despite the experience and vigilance of a cream grader skilled in detecting cress taints, its output of butter is affected and periodically graded down. A search must then be made for the offending individual supply which has passed undetected or which has not been segregated because the taint appears slight in the cold cream when received. This search entails the application of heat to samples from a large number of consignments, and although such heating can be done in hot pipes or on hot plates, the time and labour involved in the practice are considerable and add to the cost of manufacture.

Longer Processing

Further losses occur in treating the cress-tainted cream which has been segregated for extended treatment in an endeavour to minimise its effect. Such processing takes longer, the rate of treatment flow is slower, and costs are thereby increased. It is estimated that the costs of treating culled cream affected by cress and other serious taints or flavours are approximately 50 per cent. greater than that of treating the better qualities.

Too little interest is taken by many farmers in the control of cress taint, and in their neglect they penalise not only themselves, but all other suppliers to their dairy factory. The utmost care and vigilance should be exercised by every factory supplier, and those with cress-infested pastures, however small, must follow the methods of control and pasture management likely to keep the plant from spreading.

Control of cress taint lies in the grazing methods and pasture management adopted on the farm. The research of the Dairy Research Institute and the practical trials conducted by the Extension Division of the Department of Agriculture have shown the control methods that should be adopted. They should be followed thoroughly by all producers likely to have a cress infestation. Factory treatment and processing will not remove all cress taint from affected cream and considerable losses must be the result of neglect on the farm.

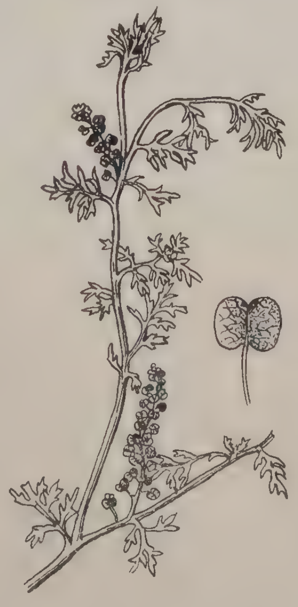
Lotus major if consumed in quantity by cows can cause a serious taint.

FARM TREATMENT AND PASTURE MANAGEMENT

The following farm treatment and pasture management are recommended to check quality faults in milk and cream.

Land Cress

Land cress (*Coronopus didymus*), also known as hog cress and twin cress in some districts, is an annual weed which is common all over the North Island. It has long trailing stems produced from a central crown, finely divided leaves, and small, white, inconspicuous flowers. It normally shows up in a pasture in late winter and early spring and may continue to give trouble until Christmas. The plant can be identified readily by the strong, mustard-like odour which is produced when the leaves are crushed. So strong is this odour that it can be noticed easily if one walks across a heavily infested field on a hot, humid day after rain.



Land cress (*Coronopus didymus*). At right is a seed capsule.

As land cress is an annual whose period of growth coincides with the period of main pasture growth, it will not usually thrive in a dense, well-managed sward of grasses and clovers. Cress gets its best chance to develop and cause trouble wherever a pasture is thin and open, and it has been found to appear most frequently under the following conditions:—

1. Where the frequent passage of stock has opened up a sward, such as round gateways and races, and on farm roads, there may be sufficient of the weed on the bare patches to give trouble in the cream, even if the main pastures are free of cress.

2. When a pasture has been very heavily stocked and pugged up over winter there is frequently a strong growth of cress the following spring.

3. Cress is often found around old hay stacks and silage pits. Even though the number of plants may be small, there are often enough to give trouble if they are eaten by stock.

4. When a pasture has become open at the bottom through over-cutting for hay or silage, conditions are ideal for cress development.

5. Pastures on which harrowing has been neglected, frequently have cress

plants growing vigorously round old cow droppings.

6. A paddock that has been opened up with grass-grub, frequently is heavily infested with cress the following spring.

7. Cress is often found in paddocks lying uncultivated after a crop, particularly on maize country. Cows in milk should never be allowed access to such areas.

8. Cress shows up frequently in new pastures, particularly on country on which there has been much maize growing. On this class of country spring-sown pastures nearly always are heavily infested with cress, and it is not uncommon to find many cress plants even in a paddock sown down in autumn, particularly if it has been stocked heavily in winter or if sowing has been done too late. On such country it is wise to sow down a pasture in early autumn once the rains have come. If spring sowing is unavoidable, the grass seed mixture should contain a preponderance of rapidly establishing species such as ryegrass and white clover.

A farmer's aim should be to maintain a dense, vigorous sward and to keep a close watch on danger areas such as round gateways and cream stands and along races.

Controlled Grazing

If a farmer finds that despite all his efforts cress is showing up in his paddocks, he should keep dairy cows off any cressy area, which should be grazed by dry stock. If this is not possible, as it may well be if a large portion of the farm is infested or if the cressy area is a paddock of new grass which is essential for the milkers, a form of controlled grazing must be practised to reduce the risk of cress taint in the cream to a minimum.

It has been found that with most cows cress taint will show up in the milk within a short time of the cress being eaten. Some cows eat cress far more readily than do others, and it has also been found that some cows produce a cress taint in milk to a greater extent than do others in the same herd. It is suspected that a sick cow passes on cress taint to a greater extent than a healthy one. Finally, it has been established that only a small quantity of cress needs to be eaten by a cow to produce tainted milk. A cow fed 1½oz. of cress produced strong cressy milk.

If cows have access to cress before milking, the risk of taint is increased. It is not necessary for the whole herd to get a good feed of cress before trouble will occur; even if one or two cows have a few mouthfuls containing cress during the afternoon, the chances of cress taint showing up in the milk from the herd are very great.

Thus the basis of grazing management for a farm on which cress is present must be removal of the cows from the source of the trouble long enough before milking to allow the taint to be worked out of the system. Usually this is found to be at least 4 hours, so that cows must be removed from cressy pastures at least 4 hours before milking. Even this will not be sufficient if a paddock is heavily infested with cress. There is one case on record where cows grazed on a heavily infested paddock between 7.30 and 8 a.m. gave a strong cressy cream when milked at 5 p.m. The best that can be said of controlled grazing is that removing the dairy herd from a cressy pasture to a clean one at least 4 hours before milking will, in all cases, result in a better-quality cream than if the cressy pasture were grazed all day.

If the infestation of cress is heavy, controlled grazing may not give a taint-free cream. On the other hand, numerous cases can be quoted where controlled grazing has given complete satisfaction, and, in any case, it is the only satisfactory method so far known by which a cressy paddock can be utilised by the milking herd.

A farmer who is trying out this system of controlled grazing is urged to let his factory manager know. If this is done, a close watch can be kept on the cream in the factory, and the risk of this cream passing the grader and causing trouble to the whole day's make of butter can be avoided.

Since the introduction of hormone weedkillers into New Zealand it has been found that 1lb. of 2,4-D acid equivalent per acre sprayed on to a paddock in spring will give satisfactory control of land cress.

A taint rather similar to that imparted by land cress is given to cream by the weed wart cress (*Coronopus procumbens*), and the general remarks pertaining to land cress apply also to wart cress.

"Feedy" Taint

The most common taint in cream is usually known as "feedy" taint. It appears to be bound up with the rate of growth of a pasture and is most commonly associated with a clovery sward. It occurs most frequently on farms on which there has been little or no winter-saved grass and where stock have been wintered on a fairly fibrous diet containing little protein. Stock wintered under these conditions appear to experience a considerable digestive upset when put on to rapidly growing spring pasture, and this upset is immediately reflected in the quality of the milk and cream, which has a strong and objectionable taint.

The more clover in a pasture in spring, the greater is the degree of "feediness", though cases can be quoted where cows have produced a feedy cream when grazed on pastures containing dominantly ryegrass and relatively little clover. As the feed hardens during the season the trouble slowly disappears until the quality of the cream goes up to Finest. Subterranean clover produces the worst taint, closely followed by trefoil and white clover.

Provision of adequate quantities of winter-saved grass, to be fed off with an electric fence, supplemented with good silage or hay will do much to reduce feediness in cream and will be a safeguard until spring growth hardens.

If a farmer has to graze his cows on clovery pastures, he would be well advised to give them access to a ration of good hay. This practice will also help to reduce the likelihood of bloat. A system of controlled grazing of clovery pastures should also be adopted and cows should be moved from such pastures on to a grassy or bare paddock 3 or 4 hours before milking.

With the increasing use of the electric fence for rationed grazing of pastures, with cows being kept on pasture 6 to 8in. high, there has been a reduction in the amount of feediness on many farms. This type of management, which aims to prevent paddocks from becoming bare, should also in the long run help to reduce the excess of clover growth that is responsible largely for feediness.

Much of the bareness of pastures on many dairy farms over winter is due to inadequate supplies of hay, silage, or other supplements for the stock carried; pastures are kept bare by stock in their efforts to supplement the lack of winter fodder. Once spring growth starts to move bare pastures come away soft and watery and very often with an excess of clover, and trouble follows when the milkers are put on to them. Thus any practice aimed at giving a fuller ration of winter feed for dairy stock will counteract baring of pastures and should help materially to overcome feedy flavour in cream.

Other Taints

On swampy country that is inclined to poach in the winter pennyroyal may be responsible for flavouring cream. On this class of country hormone weedkillers can give full control of pennyroyal. The use of 1lb. of 2,4-D acid equivalent per acre has proved satisfactory. Any type of management that will assist in maintaining a dense sward will automatically help to keep pennyroyal in check.

In the early days of dairying sweet vernal was a common and often a major constituent of many dairying pastures and it was often suspected that it tainted cream, but with the development of higher-producing pastures little is now heard of this suspected taint. Sweet vernal can be suppressed easily by good pasture management aimed at lifting the level of soil fertility and thickening up the higher-producing grasses and clovers in the sward.

The whole problem of feed taint control is bound up with healthy stock, cleanliness, and good methods of pasture management; all three are important. The farmer who feeds his stock adequately over winter, who keeps a good sward of grass and clover on the paddocks he will be using for his milkers in spring, who is clean and careful in the shed, and who keeps a close watch on the health of his stock—the good dairy farmer—should not experience much trouble in maintaining highest grading for his product.

"Basic Slag"

In the article "Basic Slag: Pasture Topdressing in the North Island", which appeared in the April issue of the "Journal", an error occurred in the caption to the illustrations on page 317. The year mentioned in the second sentence of the caption, beginning "Topdressing was suspended in 1932", should have been 1940.

Irrigation of Horticultural Crops

By L. R. RENOUF, Horticultural Instructor, Department of Agriculture, Auckland

IRRIGATION of horticultural crops has been carried out in New Zealand over a long period and has proved profitable not only in very low rainfall areas like Central Otago, but also on lighter soils and for shallow-rooted crops in higher rainfall districts where dry spells occur at intervals in the growing season. Costs involved in irrigation are often high, particularly where sprinkler systems have to be used, and to ensure that additional returns justify the costs, intelligent and economical use of the water is essential. A knowledge therefore of the principles involved is necessary and this article, which will be concluded in the July issue of the "Journal", has been prepared for this purpose.

WHEN water is applied to a soil the soil for a short time is saturated to the depth wetted; air is excluded from the pore spaces between the soil particles and these are filled with water.

In soils that have free drainage a fairly rapid downward movement and to a smaller extent lateral movement occur and water which cannot be retained by the soil passes into lower strata.

Movement of water will have practically ceased after 24 to 48 hours and the moisture status of the soil becomes more or less stable. The percentage of moisture in a soil that has been saturated and then allowed to drain is known as the field capacity of that soil.

Apart from soils that have a water-table fairly close to the surface, the movement of water in soils is negligible after drainage has ceased. It is not possible to wet a soil to less than the field capacity. The amount of water applied governs the depth of soil that is brought to this point.

The aim of the irrigator should be to apply just sufficient water to bring the moisture percentage of the soil, **over the root range of the plants grown**, to field capacity. Applying more water than required is waste and in applying less the full storage of the soil is not being utilised and more frequent irrigations will be necessary.

When the soil moisture percentage is lowered to the stage when plants wilt and do not recover without additional water this condition is referred to as the permanent wilting percentage or wilting point.

Not all plants show by wilting of foliage when this condition is reached. Decrease in the rate of growth of fruit and plants and change of colour of foliage may be indications that wilting point has been reached.

At this stage some moisture remains in the soil, but this is held by physical forces arising from the nature of the soil structure, which are greater than the forces exerted by the plant roots in their extraction of the moisture, and any taken up by the plants is at too slow a rate to prevent distress.

The percentage of moisture held in the soil between wilting point and field capacity is readily available to plants and is referred to as available moisture. Moisture percentages of soils are expressed as percentage of total dry weight of the soil.

Water-holding Capacity of Soils

Factors influencing water-holding capacity of soils are as follows:—

Soil texture, which refers to the size of the soil particles. As water is held in the soil in a film around the soil particles and between the particles at their points of contact, the finer they are the greater their water-holding capacity.

Soil structure: The manner in which the soil particles are arranged. The main influence on soil structure is the degree to which penetration of soil by water is possible.

Organic matter in the stages of decomposition has the power to absorb and hold water, and soils well supplied with this material will have a higher field capacity and therefore retain a greater amount of water than similar soils poorly supplied.

Depth and **uniformity** of soil and the presence of a **shallow water-table** are other factors.

Loss of Water from Soils

Loss of water from soils by evaporation is unavoidable. However efficiently water is applied and soil managed, water on the immediate surface layer must be lost.

The rate of loss by evaporation is governed by temperature, humidity, and wind, and also by the type of crops grown, mainly in regard to the shading or otherwise of the surface soil.

When the surface soil is wet it loses water by evaporation rapidly. As the surface dries so the rate of loss decreases.

When large cracks in soil occur evaporation losses will be increased and this also will take place where a water-table is relatively close to the surface.

Use of Water by Plants

By far the greater part of water taken up by plant roots is transpired from the leaves in the form of water vapour. Sunlight, temperature, humidity, and winds play an important part in transpiration.

When temperature is high humidity is generally low and therefore in a dry atmosphere the transpiration rate is increased. Transpiration will generally be greater on windy days than calm days.

As transpiration takes place almost entirely through the leaves, the rate at which water is used depends to a large extent on the leaf surface of the plants grown.

Water taken up by plant roots that is not transpired is held in plant tissues as water or utilised in the building up of these tissues. This water comprises only a small percentage of the total used by plants.

Frequency of Irrigation and Amount of Water to Apply

In considering the frequency of irrigations and amount of water to apply it has to be remembered that horticultural crops are produced in this country under a wide diversity of conditions. In Central Otago, where annual rainfall is very low, irrigation becomes a matter of routine and it is

Furrows laid out to obtain maximum water coverage on orchard.

only in odd seasons that sufficient rain falls to warrant altering the programme of irrigation.

In other districts in New Zealand irrigation is supplementary to rainfall and applications of water necessary to secure maximum production will vary from season to season.

The purpose of irrigation is to supply water to the soil so that available moisture is present in the root zone of the crop throughout the growing period.

If plants suffer at any stage from lack of water, the extent of loss of production and effect on quality of the produce will be governed by the length of time this condition exists.

Many factors influence the frequency and rate of irrigation required and no hard-and-fast rules can be laid down.

As a general average the available water that can be held per foot depth in different soils is:—

Sandy soils ½in. to 1in.
Sandy loams 1in. to 1½in.
Silt and clay loams 1½in. to 2in.
Clays 2in. and above.

Silt and clay loams can retain several times the amount of available moisture that is retained by some of the sandy soils. Thus sandy soils require more frequent but lighter irrigations than silts and clays to maintain available moisture.

Depth of root zone: When the moisture content of the soil is at field capacity movement of soil moisture is negligible. Therefore the moisture available to plants is contained only in the volume of soil occupied by the roots.

All plants will take most of their moisture from the upper few feet of soil and in general the greatest concentration of roots will be found in the first and second feet. Some plants (fruit trees, lucerne, etc.) have the ability to obtain substantial quantities from greater depths.

In some instances there are indications that deep-rooting plants may show distress from lack of water when available moisture in the surface layers is depleted, even though the lower roots may be on moist soil. This may be due to the top layers of soil being of high fertility and the lower layers being low in fertility.

Naturally deep-rooted plants will grow when forced to on shallow soils, but will require the same amount of water for development as when grown on deep soils. Crops grown in limited depth of soil and naturally shallow-rooted plants require more frequent but lighter irrigations than deeper-rooted plants in deep soil.

Water applied in quantities that will cause percolation below roots will be wasted on well-drained soils and leaching of plant nutrients may occur. In shallow soils on impermeable subsoils waterlogging will result.

Climatic conditions not only affect evaporation of water from the soil, but also greatly affect the rate at which water is used by plants.

When hot periods with dry winds are experienced the water usage will be greatly increased and the intervals between irrigations will of necessity be shortened. In extremely hot conditions twice the normal number of irrigations may be necessary on shallow soils.

If available moisture is not maintained even for a short time under extremely hot conditions, the check plants receive may not allow them to recover fully and production will be seriously affected.

Moisture content of soil: Research overseas has shown that growth does not vary if soil moisture is anywhere between wilting point and field capacity, but if soil is allowed to dry out to wilting point, the difficulty is to irrigate the whole area quickly enough to prevent damage to crops from lack of moisture.

Less water at each irrigation will be required if soil moisture content is above wilting point. Where water supplies are limited and irrigation equipment is such that several days are required to irrigate the area it is essential that irrigation should be started well before available moisture has been depleted.

Indications of the necessity of water can be obtained by examining the soil in the root zone by digging holes or using an auger; by watching for temporary wilting of shallow-rooted plants during hot afternoons; by noting change of colour on foliage and any stoppages in the growth rate of plants or fruit.

Penetration of water can and should be checked after irrigations to ascertain if the depth of root zone has been wetted. If 48 hours after irrigation it is found that the lower layers of root zone have not received water, larger amounts of water should be applied at the next irrigation.

As conditions vary in each area and district, it is not possible to lay down definite amounts of water or definite periods of application, but from observations made ½in. to 1in. for vegetables and 1in. to 2in. for fruit trees at appropriate intervals (before all available moisture has been depleted) have been sufficient to maintain full production.

The growing of cover crops in orchards to build up organic matter will greatly increase the demand on soil moisture. With permanent or short-term cover crops grown during summer more frequent irrigations will be necessary to maintain moisture for crop and trees.

To maintain maximum development and production from supplementary irrigation any system or works installed should be capable of applying not less than 1in. of water over the whole area to be irrigated in 7 days.

Rate of Application

The rate of application of water must be governed by the rate at which the soil to be irrigated will absorb water.

Coarse sandy or gravelly soils absorb water quickly; silts and clays absorb water very slowly. The rate of absorption decreases with time, particularly in clay soils.

A soil cultivated to a dusty condition will absorb water much more slowly than a cultivated soil left in a lumpy condition.

Penetration of water will be greater on a soil irrigated before all available moisture has been depleted than on a soil reduced to the wilting range. A good supply of organic matter in the surface soil will also increase the rate of absorption of water.

From observations made of irrigation of horticultural crops, which are principally grown on cultivated soils, the absorption rate of soils being irrigated is from ½in. to a maximum of 1in. an hour.

Water applied too quickly to be absorbed will cause excessive run-off and wastage, and erosion will occur on the steeper slopes.

Measurement of Water

To know the amount of water being applied it is necessary to have an understanding of water measurement.

Water in substantial quantities running in open ditches is measured in cusecs.

Cusec, an abbreviation of cubic foot per second, is a flow of water at the rate of 1 cub. ft. per second. One cusec flow will deliver 3600 cub. ft. of water in 1 hour. One inch of water over 1 acre is 3630 cub. ft., which for practical purposes is sufficiently near to the delivery from 1 cusec for 1 hour to say that this equals 1in. of water on 1 acre or 1 acre-inch.

One of the simplest methods of measuring water flowing in open ditches is by the use of a weir. This consists of a dam or bulkhead made of timber or metal with a notch cut in the top edge and placed across the stream. The depth of water flowing through the weir notch is measured and by consulting a weir table the amount of water passing is obtained.

When the amount of water being used for irrigation is known it is simple to work out the equivalent of depth of water applied to any area.

Multiply the number or part of cusecs by number of hours of flow and this will give acre-inches. Divide acre-inches by number of acres or part acres and depth of water applied to any area may be determined. For example:—

2 cusecs flowing for 2 hours on 1½ acres

$$2 \times 2 = 4 \text{ acre-inches}$$

$$\frac{4}{1\frac{1}{2}} = 2\ 2/3\text{in. on } 1\tfrac{1}{2} \text{ acres}$$

The amount applied is equivalent to the depth in inches over the area, and the efficiency of spreading methods will determine the evenness of distribution.

When water is taken through pipelines or hose the rate of flow is generally measured in gallons per hour (g.p.h.) or gallons per minute (g.p.m.). Without the aid of a water meter the simplest method of checking the amount of water being applied is to measure the discharge of pipe, hose, or sprinklers by noting the time required to fill a container of known quantity and divide the number of gallons by the number of minutes or fraction of a minute. This will give gallons per minute. If a number of sprinklers are used, multiply the average discharge by the total number of sprinklers.

Approximately 22,700 gallons of water are required to cover 1 acre to a depth of 1in.

By dividing 22,700 by the discharge in gallons per hour the number of hours necessary to apply 1in. of water to 1 acre will be ascertained.

When the area being covered by the total discharge is known the number of hours necessary to apply a given amount of water and the rate of application can be worked out readily.

$$\text{No. of hours to apply 1in. to area} = \frac{22{,}700 \times \text{area in acres}}{\text{Discharge in g.p.h.}}$$

$$\text{Rate of application in inches per hour} = \frac{\text{Discharge in g.p.h.}}{22{,}700 \times \text{area covered in acres}}$$

Useful information on water measurement is:—

1 Imperial gallon
= 1.2 U.S. gallon
= 0.16 cub. ft.
1 cub. ft.
= 6.25 Imperial gallons
= 7.48 U.S. gallons
= 62.5lb. weight
1 acre-inch of water
= 101.28 tons
= 3630 cub. ft.
= 22,700 Imperial gallons (approx.)
= 27,152 U.S. gallons
= 4.7 Imperial gallons to sq. yd.

To convert Imperial gallons to U.S. gallons multiply by 1.2.

To convert U.S. gallons to Imperial gallons multiply by 0.8333.

Methods of Irrigation

In irrigating horticultural crops either surface spreading (furrows or border dike) or sprinkling methods can be successfully used. The actual method will depend on:—

1. Topography of property
2. Soil type
3. Depth of soil
4. Water supply available

The conditions necessary for surface spreading methods to be effective are:—

1. Level of land such that reasonably even distribution of water can be achieved. The extent to which levelling may be carried out depends on the depth of soil and costs involved. Heavy levelling may be justified on deep soils, but on shallow soils, which generally overlie rather infertile subsoils, levelling may reduce the productivity to an extent that would not justify the operation. Contour irrigation by surface methods may be adopted on some of the moderate slopes, but high and low spots within the contours would have to be evened out to allow even distribution of water.

In established orchards where ground has not been prepared for irrigation before planting only light levelling can be undertaken and efficient irrigation of these areas would present many difficulties.

2. Soil of a nature that will not allow excessive penetration of water at the start of watering and prevent even distribution over the area. It is not practical to run water over very coarse open cultivated soils.

3. Depth of soil sufficient to allow of the preparation of furrows without undue interference with tree or plant roots and to prevent excessive water losses to the subsoil. Waterlogging can readily occur on shallow soils overlying an impermeable layer.

4. Water supply sufficient to allow even distribution and for the area to be watered within the time limit. Coarse sandy soils require a larger flow than do silts and clays.

Provided all the above conditions on the area to be irrigated are satisfactory, all horticultural crops can be efficiently irrigated by surface methods.

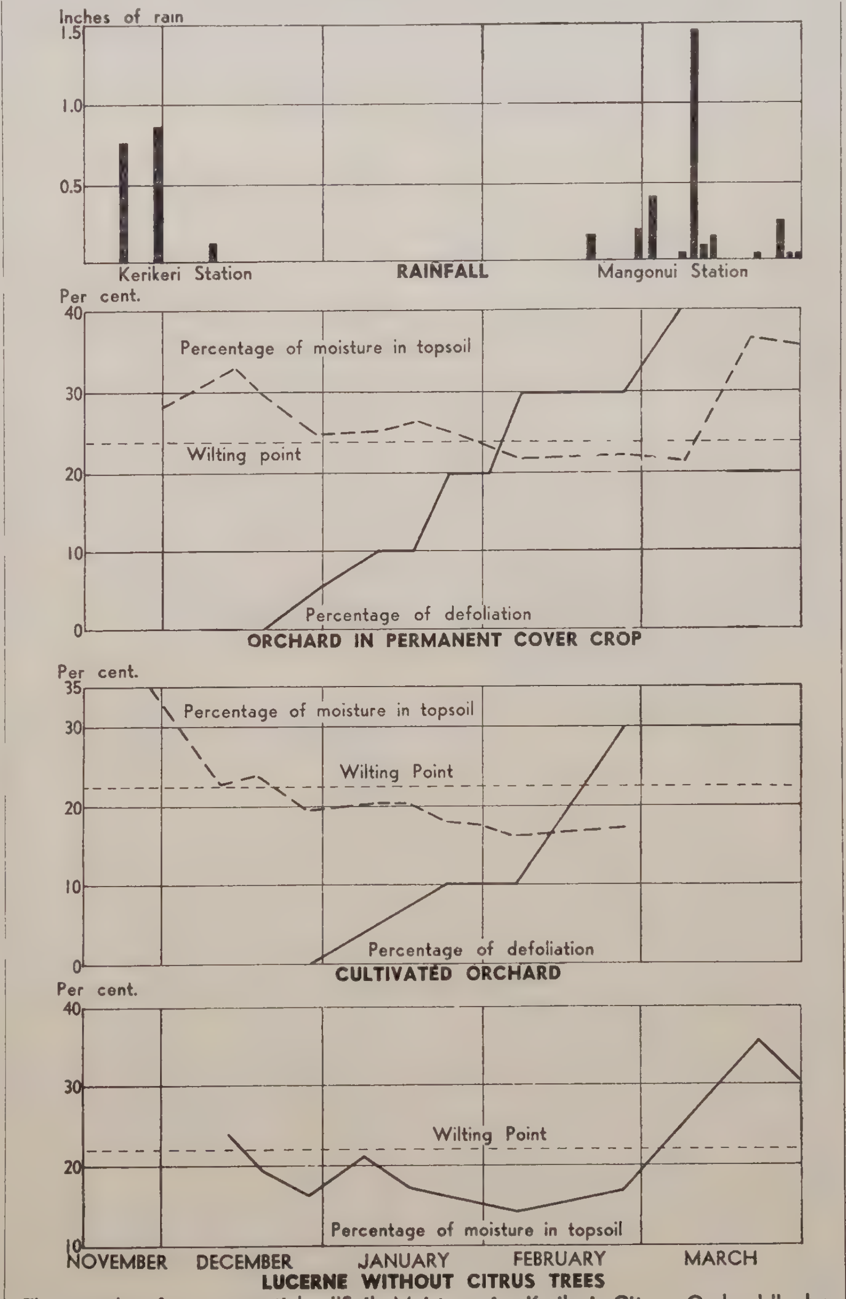
Irrigation by sprinkling can be carried out effectively over a wide range of conditions. Land with a rough surface and shallow and highly erodible soils can be watered by this means. Small quantities of water inadequate for surface irrigation can be efficiently utilised.

The selection of the method of irrigation to be adopted can be arrived at only after all factors on individual properties and comparative costs have been considered.

Furrow Irrigation

The most common and practical method of surface irrigating horticultural crops is furrow irrigation. The main difficulty in operating this system is in obtaining reasonably even distribution over the area, in that land at the head of the furrows receives more water than land further along the rows.

This difficulty can be greatly minimised by giving consideration to the



ORCHARD IN PERMANENT COVER CROP

CULTIVATED ORCHARD

LUCERNE WITHOUT CITRUS TREES

The graphs, from an article "Soil Moisture in Kerikeri Citrus Orchards", by G. M. Bruere and P. Everett, published in the November 1947 issue of the "Journal", show the variations in soil moisture during a dry summer and the effects of lack of available moisture on citrus trees.

laying out of the land in regard to length of furrows, grade of furrows, and spacing of furrows.

Length of furrows will be governed by the permeability to water of the soil type. On soils with a high penetration rate water cannot be run for long distances efficiently.

In sandy soils furrows not exceeding 200ft. to 300ft. in length are advisable. In loam soils this could be increased to 400ft. to 600ft., while on heavier clay soils the length of run could be further increased and still permit fairly even penetration.

The grade of furrows should be determined by their length and by the soil type. Where short furrows are used the grade can be much less than where long furrows are used. On light sandy soils that absorb water rapidly a greater grade is necessary than on loam soils that absorb water more slowly.

Grades of 3in. to 9in. per 100ft. for sandy soils, 2 to 6in. for loam soils, and 1 to 3in. per 100ft. for clay soils will allow more even distribution of water. In irrigating in straight furrows of grades steeper than 12in. per 100ft. difficulty will be experienced in controlling the water without scouring occurring.

The spacing of furrows for cultivated crops is determined by the distance apart of the rows. For vegetable crops generally planted in narrow rows furrows are run between each row or between two rows planted on raised beds. For vegetable crops planted at wider distances and for fruit trees and plants a number of furrows will be necessary and the spacing will be governed by the root range of the plants and the soil type.

Regardless of the method of irrigation used, the aim of the irrigator should be to wet as much as possible of the soil in the root zone of trees or plants grown. The greater the volume of soil wetted in the root zone the greater the volume of water available for plant use. The rate of absorption of water by the plants will not increase, but the advantage is in extending the periods between irrigations.

Spacing of furrows in wide-row plantings is governed by the soil type to be irrigated. When water is applied to most well-drained sandy soils the tendency is for it to move downward much more rapidly than sideways. On these soils furrows would necessarily be fairly close together.

On loam and clay soils with permeable subsoils the distance between furrows may be increased, as more lateral movement of water takes place on account of the slower absorption rate of these soils.

On soils that overlie close-structured subsoils that slow down the rate of penetration, the lateral movement of the water will be greatly increased and furrows may be placed still further apart.

The ideal spacing of furrows would be such that the soil just below the surface half-way between furrows will be wetted at the same time as the lower limit of the depth to be wetted. This spacing can be ascertained only by investigation on the area to be irrigated. The digging of a trench across the furrows 48 hours after irrigation will show a clear picture of the distribution of the water applied. Generally furrows 2ft. apart on sandy soils and 3ft. to 4ft. apart on heavier soils will allow of fairly even distribution of water. Fairly wide-based furrows are required for these distances.

In orchard irrigation young trees can be efficiently irrigated in the first year by running one furrow down each side of the rows, but to obtain full development of the root system more furrows should be added each year until after 3 or 4 years the whole area between trees is being irrigated. Where large trees prevent the making of furrows near the trees large spaces in the rows between outside parallel furrows will not receive water. Consideration should be given to preparing short cross furrows to wet these areas.

To obtain the best results from furrow irrigation a fair volume of water should be let into each furrow and made to reach the lower end as quickly as possible. The flow of water should then be adjusted until it just reaches the end of the furrow and should be allowed to run until the desired penetration has been secured.

In general a fairly large flow for a relatively short time should be used for sandy soils and a small flow for longer periods on loam soils.

Border Dike Irrigation

Although not practised to any extent, border dike irrigation can be used successfully in orchards. It consists of building up small levees or borders along the tree rows and running the water over the whole of the surface between two rows at one time. A fairly large flow of water is required.

The strips to be irrigated have to be level from border to border and have a slight fall in line with that suggested for furrow irrigation, from top to bottom of strips. The flow of water let in at the top of the strip should flow in an even film from border to border toward the bottom. When it reaches ¾ to 4/5 of the distance required the flow should be cut off and the accumulated water will continue on and wet the lower end of the strip.

The flow of water required for efficient irrigation by this method will be decided by the porosity of the soil and the grade of the land. This can be arrived at only by experiment.

BOOK REVIEW

"Squatter and Settler in Waipara County": D. Cresswell

MR. D. CRESSWELL, who recently wrote a book about Cheviot, has now produced a similar work on Waipara County. This part of the country has some very early links with the beginnings of pastoral farming in the South Island, for at Motunau, previously the site of a whaling station, the Greenwood brothers squatted in 1846 or 1847 after they had sold Purau. The author suggests that they were the pioneer squatters in the South Island and not Clifford and Weld at Flaxbourne, as is usually assumed.

After the Greenwoods the next to arrive in the district was Caverhill, who, with his partner Waitt, took over Motunau, and they were soon followed by Clifford and Weld, who had decided to extend their operations in the South Island. The book contains some long extracts from their letters about the difficulties met with in bringing stock from the north through unmapped country. Weld's contact with Stonyhurst, when it had been established, could never have been very great, especially after he had entered politics. Though he retained an interest in the property, Weld left New Zealand in the 1860's. The name of Clifford has always been linked with Stonyhurst and few large properties in New Zealand can have been held for a longer period by members of the same family.

In 1853 George Henry Moore arrived in Lyttelton from Tasmania, where he already had nearly 20 years' experience as a sheep farmer, and after exploring Canterbury for a few months he decided to establish himself at Glenmark. Over the next 30 years he gradually built it up to be the most valuable estate in New Zealand. Unlike many of his fellow pastoralists, he took no part in public life and did little to win the esteem of his contemporaries. Glenmark was the basis of one of New Zealand's largest fortunes and in the 1880's Moore built a fantastic mansion, luxuriously furnished inside, but without windows or doors at the rear. Within 3 years of its completion it was burnt down.

The other large estate in the district, Horsley Downs, had a more chequered history and was finally cut up and sold in 1896 after the owner's bankruptcy. In its last few years it was held by James Lance, who with other members of his family was noted for his hospitality and openhandedness. As a Member of Parliament he was an early advocate of the establishment of a Department of Agriculture.

More than 50 years ago the subdivision of these large estates began and as it progressed many of those who had worked on them had the opportunity to take up farms in Waipara County. It is from some of the older farmers who took up land in the 1890's or later that Mr. Cresswell has gleaned much of his information about the great estates. Some of these farmers, or more often their fathers, made a start through contract cropping, a method which was widely used to break in much of the ploughable land in the South Island. The author does not say very much about the changes in the farming pattern over the years; most of the book is concerned with the people who settled in Waipara County, which, no doubt, will add to its local interest.

It was in this district that James Little brought his work of developing the Corriedale breed to completion, and today there are a number of well-known Corriedale studs in Waipara County. Some reminiscences of Little's family give an interesting insight into his character.

The book contains early photographs and line drawings as well as a fine collection of aerial photographs which bring out very clearly the character of the Waipara countryside.

—*P.R.S.*

Waipara County Council: Pegasus Press. 22s. 6d.

Maintenance of Pastures of Matamata and Piako Counties

By G. A. BLAKE, Instructor in Agriculture, Department of Agriculture, Matamata

SINCE farming by Europeans started in Matamata and Piako Counties in the Waikato the pastures have had a chequered career. The settlers soon found that though pastures could be established relatively easily, their maintenance was difficult, because as the original cover was fern and scrub, the soil lacked the reserves of plant food that were built up in other districts originally in bush. Consequently, when the era of phosphatic topdressing arrived, fields of varied productivity awaited the transformation into fields of permanently high production which did not need ploughing.

YET from an unpromising beginning, higher and yet higher amounts of production are being obtained year by year, and higher and yet higher goals are being set. It is not so long ago that it was considered almost miraculous for a farm to produce 300lb. of butterfat per acre, and this figure today, though not by any means commonplace, is no longer the objective, and 500lb. of butterfat per acre may be the next goal.

High Percentage of Poor Pastures

Nevertheless, despite these heights of production, a pasture survey conducted in the Morrinsville district showed that about one quarter of the pastures were composed mainly of weeds and inferior types of grasses with little or no clover and half of a mixture of good and poor species, leaving only one quarter which could be considered good dairying pastures.

Remedial action is called for and some will say that the answer is simple: All that farmers have to do is to replace inferior species with better ones by ploughing, preparing a suitable seed-bed, and sowing the better species. Others more cautious will reason that some of these pastures once contained good species and that there are some pastures which were once much worse than the present poor or good ones. That is conceded readily and only goes to show that management is important in maintaining or improving a pasture. Where a pasture is not thriving the cause must be sought, and once the defect is remedied the better species may be introduced profitably and with confidence, for if the poor species present are not thriving, newly introduced ones which demand higher fertility will also fail to produce. A parallel well known to stockmen is that it is better to keep animals inured to hard conditions than to introduce animals used to soft conditions on to a farm with poor feed.

Uneven Stocking

Pasture deterioration is caused most commonly by uneven distribution of stock grazing, and generally this is brought about by the frequent closing of a field for hay and the feeding of all or some of the crop elsewhere on the farm. This was the most common cause of deterioration of paddocks examined in the Morrinsville survey. The poor fields were usually the ones at the back of the farm, consequently ill served with water, and those closed most frequently for hay. It is little use sowing the better species of pasture plants and expecting them to thrive under a continuation of these practices. Frequently farmers unwittingly denude soil of such fields of potash through the amount carted away in hay, though the phosphate and lime status is maintained by topdressing. Rapid improvement of such fields cannot be brought about without the application of potash, and if the deficiency is very great, 2cwt. per acre of muriate of potash may be required.

The urine of grazing animals ultimately will almost maintain the potash content of the soil when fields are grazed evenly. Potash deficiencies can be discovered easily by soil testing or by the application of potash to a portion of the field. Responses from potash usually are revealed in a few weeks and are more convincing than soil tests.

Once the farmer is convinced of the reliability of the treatment he can consider the introduction of better species. By this time the pasture may have been improved somewhat by better management and he may be reluctant to plough, but surface sowing may make an appeal. Unfortunately surface sowing allows only some of the better species to be incorporated, and only after the field has been well harrowed when the pasture is bare in autumn. Nevertheless, the introduction of new species has a value, as these species, if given the right treatment, will thrive and under good grazing management ultimately may replace many or all of the old species. Hence per-acre sowings of 10lb. of perennial ryegrass, 5lb. of short-rotation ryegrass, and 2lb. of white clover ultimately may improve the sward considerably. Short-rotation ryegrass is worth while only where the soil is very fertile and moist during summer and where grazing is fairly lax in spring. On fat-lamb farms short-rotation ryegrass should be introduced with caution, and where the fertility is not quite sufficient for the demands of white clover subterranean clover will be useful. Subterranean clover can be introduced at the rate of 2 to 3lb. per acre.

Ploughing Necessary

For speedy improvement the plough usually is the only answer. The sowing of the pasture may be preceded by a course of cropping. On light soils the grass-to-grass method frequently advocated is to plough in November a flat furrow, roll on and in the direction of the furrows, and disc and harrow the surface. Further work consists of rolling and harrowing several times until the required firm and fine seed-bed is ready for sowing in March. On clay soils earlier ploughing and more thorough preparation are needed to break up the clods before dry weather makes this difficult or impossible before autumn and to mellow the soil.

HEADING PHOTOGRAPH: Heavy concentration of young stock on new pasture on a Matamata farm.

RENEWING AND RENOVATING PASTURES

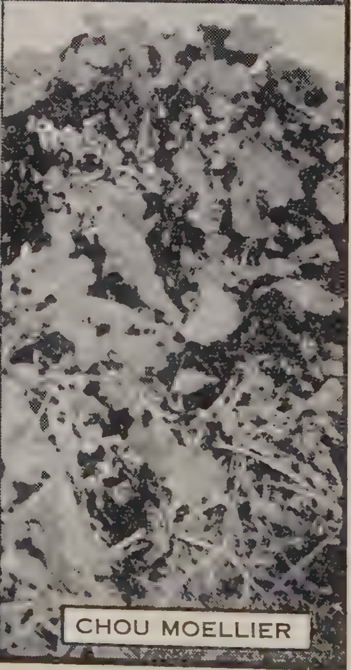
Despite the high production often achieved on farms in Matamata and Piako Counties, pastures on many farms contain a high proportion of inferior grasses and weeds and lack clovers. Rapid improvement can be brought about only by ploughing or discing up these poor pastures and resowing with Certified seed with a good germination percentage. Procedure for preparing the seed-bed can be varied from a grass-to-grass method to include the sowing of a temporary pasture of Italian or short-rotation ryegrass and cowgrass or of a winter forage crop such as chou moellier. Irrespective of the method by which the paddock is worked up the aim is to sow the permanent pasture mixture on a fine and firm seed-bed and one of the essentials is adequate rolling. Though best results will be obtained by ploughing up and resowing deteriorated swards, paddocks sometimes may be renovated satisfactorily by oversowing on the existing sward after a seed-bed has been prepared by harrowing the sward drastically. As many of the pastures which require renewing or renovating once contained good grasses and clovers, deterioration has been due to incorrect management, and the work and expense involved in improving pastures will be wasted unless the cause of the deterioration of previously good swards is eliminated.

DRASTIC HARROWING

GOOD DAIRY FARM SWARD

ROLLING ON FURROW

TEMPORARY PASTURE (ITALIAN RYEGRASS-COWGRASS)


CHOU MOELLIER

When a root crop (such as the swedes shown) is sown on a recently ploughed paspalum pasture the paspalum tends to rejuvenate and smother the crop. Autumn ploughing followed by a sowing of oats and Italian ryegrass reduces the chance of paspalum recovering.

Cropping Rotation

A cropping rotation for the establishment of new grass that has given good results consists of early ploughing for swedes or chou moellier followed by soft turnips for autumn feed and then resowing to pasture. Generally land should be ploughed deeply for swedes and rolled on the furrow to prevent air pockets and to smother the sward. This deep ploughing also buries the weed seeds usually found in the top inch or two of soil and gives a clean seed-bed for the swede crop. If a seed-bed for the following crop of soft turnips can be prepared with discs and harrows, this method of cultivation is recommended, but if ploughing is considered necessary, the plough should be set to work at a less depth than the original ploughing so that not too many of the weed seeds buried then are brought up. Soft turnips of the Purple Top Mammoth variety sown in mid-October will be ready about the beginning of January. This crop may be pulled and fed out or grazed by the herd. Turnips should be fed for an hour immediately after the morning milking, as this reduces risk of feed flavour from this crop to a minimum. For both swedes and soft turnips good crop utilisation is secured by giving the herd a fresh break every day, using the electric fence. This system concentrates the animal manure on the area being grazed and tramping assists in the consolidation of the soil, a very necessary adjunct to a good take of grass.

Preparation for New Pasture

During February the preparation of the seed-bed for the new pasture should begin. If the field is clean, discs can be substituted for the plough, but if ploughing is necessary, very shallow ploughing will suffice to form a seed-bed. As much soil as possible should be left consolidated. All subsequent cultivation is aimed at producing a fine, firm seed-bed, and constant use of the roller and the harrows will achieve this. Most new pastures are sown on land that is too loose through insufficient consolidating cultivation after deep ploughing. The familiar sight of good germination wherever a horse has put its foot or along the wheel marks of tractor or topdresser and on headlands is an object lesson on the effect of consolidation.

Low germination of grasses and clovers allows the ingress of weeds and delays the formation of a close sward.

Lack of consolidation may result in the burying of the seed too deeply, with a consequent poor strike.

Many farmers try to overcome lack of consolidation by sowing up to 60lb. or more of seed per acre, whereas with greater care in the preparation of the seed-bed this amount could be reduced to 40lb. per acre.

The seed should be sown on the rolled surface with 3cwt. of phosphatic fertiliser per acre and covered lightly by using a drag chain attached to the ends of the topdresser or by using a brush harrow. If lime is to be applied, it should be spread after the last deep cultivation to leave it as near the surface as possible. On peaty soils, however, lime should be applied after ploughing and disced in to a depth of 4in.

Pasture Seed Mixtures

A typical seed mixture for dairy pastures on silt loam and clay loam soils is as follows, but individual requirements may necessitate slight alterations or additions and intending sowers are advised to consult the Extension Division instructor at the nearest office of the Department about the suitability of this mixture for their soil type:—

	lb. per acre
Certified perennial ryegrass	15
Certified short-rotation ryegrass	15
Certified cocksfoot	5
Certified timothy	2
Certified white clover ..	2
Certified cowgrass	3
Total	42

On sandy loam soils, such as are found around Matamata and Tirau, the following mixture is recommended:—

	lb. per acre
Certified perennial ryegrass	20
Certified short-rotation ryegrass	10
Certified cocksfoot	6
Certified timothy	2
Certified white clover ..	2
Certified cowgrass	3
Total	43

If desired, Montgomery red clover may be sown instead of cowgrass, as the former is more permanent, but cowgrass makes earlier growth in spring. It is also an ideal species for early hay crops and produces a good aftermath.

In many districts rape is the best lamb-fattening feed to follow swedes, but owing to the high rainfall usually experienced in the Waikato in December, the crop becomes too rank and fails to ripen in time to be of much value. Chou moellier, sown during September at the rate of 2½lb. of seed per acre, will be available for lambs in January and February. After this crop the land is prepared for the sowing of the grass mixture.

Excellent results have been obtained by discing and harrowing the surface lightly and sowing the seed among any stalks of chou moellier that remain.

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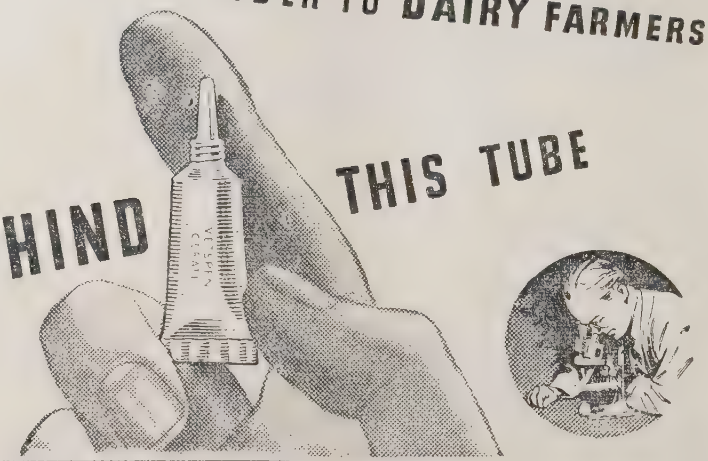

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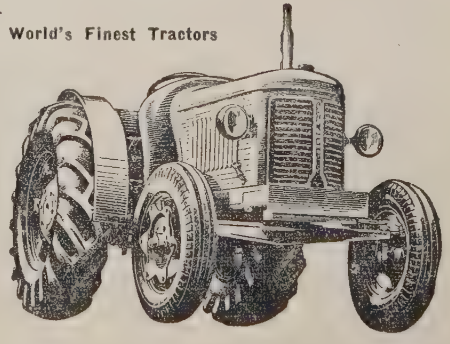

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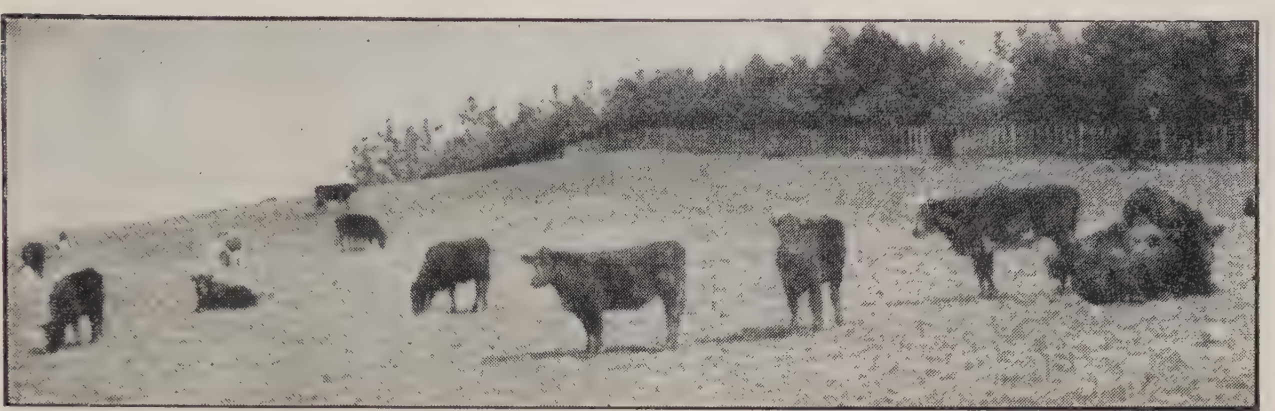

Cropping allows most of the farm to be spelled while the stock are consuming the crop.

Where crop residue has been ploughed in the sheep farmer is better able than the dairy farmer to achieve sufficient consolidation, as he can employ his ewes instead of a roller. By driving the sheep over the field several times he can obtain excellent consolidation. The seed and manure are then sown and covered with a brush harrow or by further tramping. It should be noted that the flock must be used before the seed is sown. If seed is sown on a loose seed-bed and then tramped in, some of it may be pushed too deeply into the soil to germinate. A suitable seed mixture for fat-lamb farms in Matamata and Piako Counties is as follows (slight alterations may be necessary to suit individual fields):—

	lb. per acre
Certified perennial ryegrass	25
Certified Italian ryegrass ..	5
Crested dogstail	3
Certified cocksfoot	4
Certified white clover ..	2
Subterranean clover ..	2
Certified cowgrass	2
Total	43

Though the swede-soft turnip-grass rotation is suitable for practically the whole of these two counties, there is a small area of low-lying land in the middle of Piako County where willow weed and amaranthus (redshank) are so troublesome that a second crop cannot be grown successfully because of smothering by these weeds. On this area the cropping programme must be limited to one crop before regrassing. If winter feed is required, swedes or chou moellier can be sown and in spring the land can be returned to permanent pasture. Where autumn sowing of permanent pasture is preferred a temporary pasture of 25lb. of Italian or short-rotation ryegrass and 5lb. of cowgrass can follow the winter crop, and 18 months later the area can be resown to permanent pasture, either after reploughing or by surface sowing. If the latter method is adopted, 2lb. of white clover seed can be sown with the temporary species. If an autumn crop is desired, soft turnips or chou moellier can be grown, but after utilisation the land must be returned to permanent pasture. With both methods of resowing some weeds will appear in the new pasture, but they can be controlled by topping until frosts occur.

Many of the pastures in Matamata and Piako Counties are sodbound paspalum and produce very little feed for only a short period each year. Although drastic harrowing and surface sowing improve them slightly, a better and quicker result is obtained by ploughing and regrassing after cropping. These paddocks should be ploughed in March, after the paspalum has made its main growth, and the land rolled on the furrow to prevent regrowths along furrow edges. Light cultivation that does not bring any grass to the surface precedes the sowing of 2½ bushels of Algerian oats per acre in April to provide feed in August, when it is usually very scarce on farms where paspalum is the dominant grass. An alternative sowing is 1 bushel of oats and 1 bushel of Italian ryegrass, the oats being drilled or disced in and the ryegrass sown on the surface and covered lightly.

This mixture will provide feed until September, when the land can be prepared for soft turnips or chou moellier, but as these crops are not often required where paspalum is present, the oats and ryegrass can be left for a hay or silage crop and the land returned to permanent pasture in autumn.

Cropping in Relation to Pasture Improvement

Apart from the cropping programme adopted in the preparation of the land for the sowing of permanent pasture, cropping to supplement periods of shortage is advantageous to the sward. It allows most of the farm to be spelled while the stock are consuming the crop, thereby making conditions unfavourable for the growth and spread of weeds which otherwise would be induced by the close grazing of the stock in their search for food during periods of feed shortage.

Where the general standard of pastures on a farm is low the growing of lucerne, if conditions are suitable, will obviate the haying of much pasture and so lessen further deterioration of the already low-producing sward. It will also allow a greater number of stock to be carried, which in turn results in pasture improvement. During dry summers lucerne can be used as a green crop, and 12 acres per 100 cows is considered the necessary area to supplement the pastures and crops available to the herd throughout a prolonged drought.

All Waikato land is not suited to lucerne growing and where pastures are poor reliance is placed on swedes for winter use. The ease with which they can be grown and the certainty almost always of a good crop make them an ideal food for winter, again reducing the area that need be cut for hay and so preventing sward deterioration. Browntop and sweet vernal are very prevalent in some of the pastures and cropping with swedes, followed by a summer crop, eliminates these poor species. Grazing of crops also brings about the consolidation so necessary for the establishment of new grass.

Crops such as millet and maize, which belong to the grass family, should not precede the new sowing, as they leave the soil poorer, when the aim is to improve it so that better pasture species will thrive.

Care of New Pastures

New pastures should not be allowed to become rank. If sheep are available, the first grazing—when the pasture is 3 to 4in. high—should be done with these animals, but failing these, young dairy stock are suitable. The aim should be to eat off the growth to about 2in. high as quickly as possible and under no circumstances to set stock it. This procedure is followed as often as necessary until the field takes its place in the rotation. New fields should not be harvested for hay or silage until they are 3 years old, but if seed heads appear in the first year, they should be removed by topping. Adequate fertilising with phosphates is essential to the establishment of a new sward. Besides the 3cwt. per acre applied with the seed a further application in spring is advisable to ensure the success of the new sowing and bring it to its maximum production in the shortest possible time.

Care of Established Pastures

It is from the established pastures that the wealth of the farm comes and when it is realised that at today's prices for dairy products each acre is capable of producing over £40 per year for many years, the value of a good sward is very evident and well worth the care necessary for its maintenance.

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Adequate subdivision by stockproof fences or hedges is essential for correct utilisation of pasture growth. Above—Lawsoniana hedge that has been interplanted with eucalypts to give better shelter. Right—Barberry, a suitable hedge for subdivision.

Size of Paddocks

Without adequate stockproof fences the correct utilisation of grown grasses is impossible. Topographical features such as creeks and hills control to some extent the size of individual paddocks, but where possible these should be of a size to accommodate the herd at the rate of 15 cows per acre; thus for 90 cows most of the farm should be divided into 6-acre paddocks. This allows complete utilisation of the herbage grown in each of them. It does not mean that the whole of the farm should be divided into equal-sized paddocks, though this is the ideal, but that sufficient fields should be provided to allow each to be grazed at 14-day intervals. On fat-lamb farms this period may allow the grass to become too long for lambs, but this is easily overcome by dividing the flock into smaller groups so that fields are grazed at about weekly intervals. Dairy pastures produce the most herbage of reasonably high feeding value when they are allowed to grow about 8in. high and are then eaten down to 2 to 3in. high.

Rotational Grazing

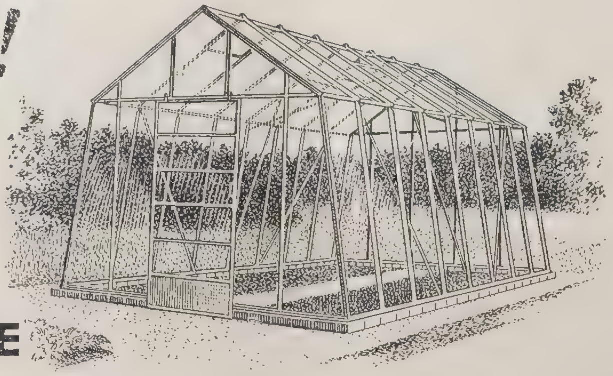
Rotational grazing has been partially dealt with above, but unless rotational grazing is practised, the better grasses tend to become eaten out while the less palatable and inferior types are neglected and thus become more aggressive and finally dominate the sward. Rotational grazing allows the sward to make some growth before being grazed. This strengthens the pasture plants and more feed is produced as a result. Close, continuous grazing of new growth checks plants and unless allowed to develop the more valuable species will eventually disappear. True rotational grazing, where the stock spend both day and night in each field, lessens the transference of fertility from back paddocks to those around the cowshed. The practice of using some of the latter as night paddocks cannot be commended, as these fields are built up to a high state of fertility at the expense of the day paddocks and eventually the sward in the night paddocks is unable to utilise all the plant food carried into them by the stock, which results in waste of this plant food and often makes the herbage unpalatable.

It is almost essential to have a central race to carry out rotational grazing. This race, unless concreted or metalled, should be made wide enough to prevent it from becoming muddy. In reality the race becomes a long, narrow paddock that still produces grass and is used in conjunction with each field as it is grazed in the rotation. As spring growth increases it will be found that stock are unable to eat all the grass. When this happens some fields should be closed for hay or silage and the stock restricted to the acreage on which they can utilise all the grass. As the growth decreases, harvested fields are brought into use. In other words, the number of paddocks over which the stock graze should be reduced until they can eat all the grass grown on the reduced area and the balance should be conserved as hay or silage for periods when grass growth is insufficient to support the herd. This may mean prolonging the harvesting season into autumn, but only by this means can high production per acre be obtained. Where calves are reared on the farm it is as necessary to rotate them around the farm as it is to rotate the dairy herd. Calves are very selective grazers and if confined to one paddock for long become short of feed, though there may appear to be plenty available. In calves in this semi-starved condition stomach and intestinal worms gain the upper hand and drenching becomes necessary, but even so, some deaths occur. Under rotational grazing ample feed is provided, the calves are always thriving, and worms, present in all calves, have no effect on them. For best results calves should be grazed several days ahead of the cows and shifted at least twice a week. Better, larger, and healthier calves will be reared without loss.

Closing for Spring Feed

The practice of closing some fields in autumn for utilisation in late winter and early spring after the herd has freshened is now widely used, and can be commended, as feeding trials have demonstrated that cows must be particularly well fed in late winter and early spring to produce to their capacity. Care must be taken, however, not to close the same fields each year or they will revert mainly to Yorkshire fog, one of the inferior grasses, and in so doing will suppress to extinction the clovers, the most valuable component of any sward.

In feeding off autumn-saved pasture, the use of the electric fence is essential if waste is to be avoided. With grass about 8 or 9in. long, each dairy cow should have access to 45 to 50 sq. yds. per day plus any hay or silage that is available.



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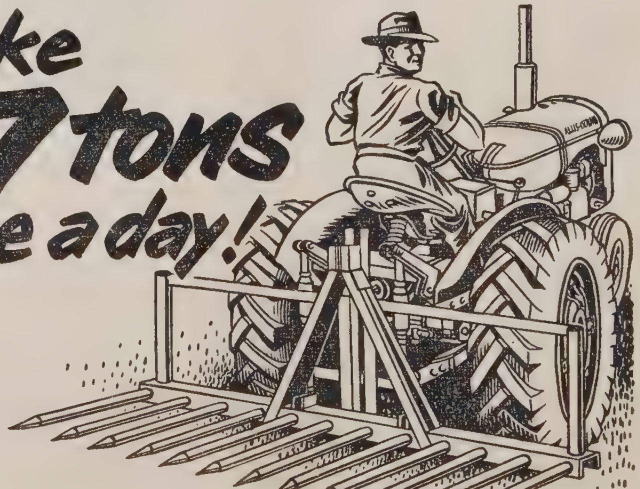

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Dairy farm pastures produce the most herbage when they are allowed to grow to 9in. high and are then eaten down quickly to 2in. high.

Hay may be fed out on the area grazed off the previous day or it can be fed out on a poor paddock, where it will be eaten by the stock when they are moved from the autumn-saved pasture.

Up to 40 per cent. of a dairy farm should be closed by the end of April to ensure that there is sufficient grass to last to the end of September.

Topping of Pastures

The topping of pastures to prevent seeding is losing favour in some quarters due to a mistaken idea that it is necessary to allow grasses, particularly perennial ryegrass, to reseed to maintain the sward. It is not realised that the better strains of ryegrass are permanent. Where short-rotation ryegrass is prevalent in the sward some lax grazing in late spring may be advisable to permit reseeding. If rotational grazing has been practised and all surplus feed converted into hay and silage, there should not be much necessity for topping, except perhaps on newly sown pastures to prevent their seeding and on those fields where the strong growth around the cow droppings has been neglected. Many fields in Matamata and Piako Counties are badly infested with buttercups and here also topping to prevent reseeding of the weed and the smothering of the grasses and clovers of the sward is advocated, but a better method of control is to spray this weed with one of the hormone sprays.

Where paspalum is almost dominant in the sward, topping becomes a necessity, as this grass often produces more than the stock need during summer with the result that much of it runs to seed. In this condition it suppresses the clover, and with the first frost of the season the roughage becomes unpalatable and useless as a fodder.

Harrowing

Pastures should be harrowed, but the choice of harrow needs careful attention. On good ryegrass and white clover swards all that is needed is a tripod and chain harrow heavy enough to break up and spread the droppings completely and so lessen the area of the farm growing rank, unpalatable grass around undisturbed droppings. The supposed aeration of the soil by drastic harrowing is a myth and on good pasture more harm than good results from such harrowing. Where the sward has become sodbound with browntop or paspalum drastic harrowing is beneficial. Again, where surface sowing is to be carried out drastic harrowing is necessary on any sward. The ideal is to harrow each time the fields are eaten down, but this appears unattainable on most farms for various reasons. The compromise should be to harrow as often as possible after grazing, especially on fields where stock have been concentrated for feeding hay and other supplements, and before paddocks are closed for hay or silage.

Topdressing with Phosphatic Manures

In common with most New Zealand soils the soils of Matamata and Piako Counties are deficient in phosphates and only by continued use of phosphatic manures can production be maintained. Provided sufficient clovers are present in the sward, the use of phosphates invigorates them and in so doing the bacteria in the root nodules manufacture nitrogen from the soil air and moisture for the use of the clover plants. On strongly growing clover there is an excess of nitrogen collected and this is available for use by the grasses, and only by the use of nitrogen can grass growth be obtained. The grasses and clovers are eaten by stock and the unused residues are voided back on to the pasture to assist in raising the general fertility of the field. In other words, the clovers are topdressed so that they will provide nitrogen to make more grass growth to carry more stock to return more dung and urine to the field. Unless clovers are present, topdressing with phosphates will not significantly raise production, but oversowing with clover seed can rectify the position.

Trials in these counties indicate that the use of basic slag, superphosphate or serpentine superphosphate, with lime, gives comparable results, but serpentine superphosphate is preferred by many farmers because of its ease of spreading and non-setting nature.

To obtain the utmost efficiency from topdressing, using either serpentine superphosphate or "super. compound" it should be applied immediately before or during a growing period. This allows the phosphate to act soon after rain falls in autumn or soon after soil temperature rises in spring. Thus these fertilisers can be applied in late February or early March for the expected autumn growth; in late August or September in expectation of normal spring growth; and when a field is closed for hay or silage, to give a larger crop, and again immediately after harvesting silage, to increase the amount of aftermath.

A topdressing programme that has given good results in these districts is to topdress the whole farm in late February or early March with any of the phosphates, to topdress in late August and September with superphosphate that portion of the farm not intended for harvesting and including fields closed for autumn-saved pasture, and to topdress that portion of the farm harvested for silage immediately the harvesting of each field is completed. The September topdressing induces more grass on the portion of the farm on which the stock are to be carried while fields are closed for hay or silage, and the application after silage harvest ensures a larger aftermath for early-summer use. Usually after haymaking the soil is too dry for topdressing to be effective.

Use of Potash Manures

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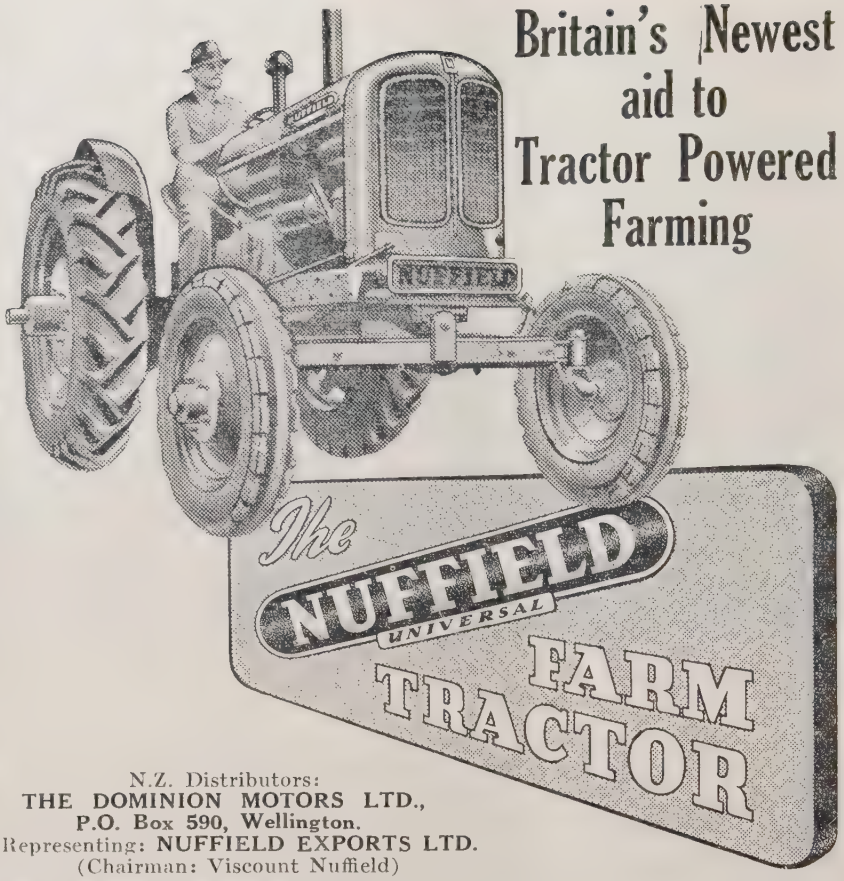
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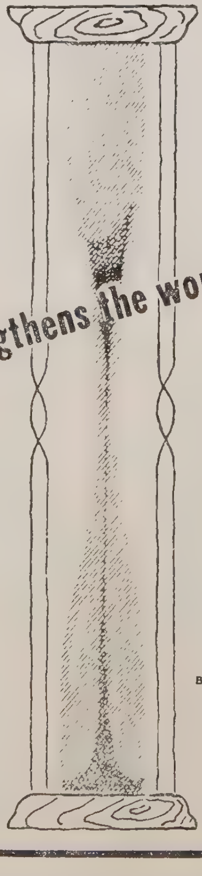

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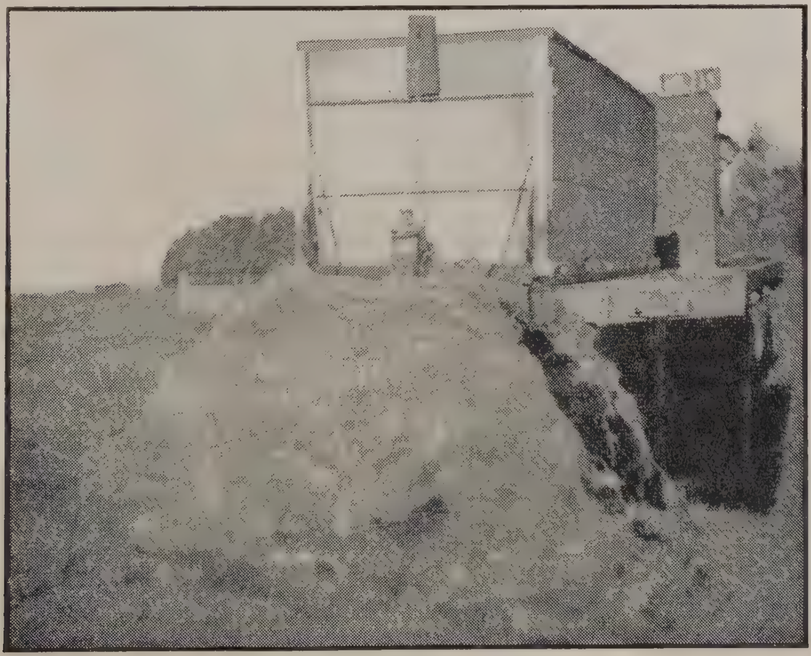
losses in potassium and magnesium, but the latter has been maintained where serpentine superphosphate has been used. Though in the past superphosphate and lime have given excellent results, greater consideration must be given now to the use of better-balanced fertilisers through the addition of potash and possibly magnesium. Particularly is this so on peaty soils, however well consolidated, where outstanding results have been obtained from the use of potash. In general, all soil types in Matamata and Piako Counties need potash, but except on peat soils not every field needs it. On farms where day and night paddocks are the rule acute potash deficiencies have been brought about by the grazing animal. Again, the continual harvesting of the same paddocks has created such a deficiency of potash that serious sward deterioration has resulted. Even if the cut material is fed back on the paddock from which it was cut, losses in harvesting and curing reduce the value of the stock voidings and a gradual deterioration takes place. If the topography of the country is such that other paddocks cannot be harvested, the paddocks cut continuously will need an application of potash, and local results indicate that the minimum dressing should be 1cwt. per acre per year. This can be applied in autumn, in the spring before closing, or, if showery weather is being experienced, immediately after the crop is harvested.

Potash is needed on many soils in Matamata and Piako Counties. The effect of potash topdressing is shown in the good growth of white clover and *Lotus major* on the portion of the paddock at left. The area at right did not receive potash.

Almost all the silt loams and peaty loams of the flat country between the Piako and Waihou Rivers, the sandy loams of Matamata and Tirau, and the pumice soils of Putaruru and Tokoroa need potash in varying amounts, and two or even three annual applications of 1cwt. per acre are needed to correct the deficiency, after which the use of ½cwt. per acre per year or 3cwt. of potassic superphosphate per acre should maintain the improvement, provided that better pasture management is also practised. The first indication of potash deficiency is a reduction in the amount of white clover in the sward and a tendency for it to grow in patches. The first visible result from an application of potash is an increase in the amount of clover, and after the first year, an increase in the ryegrass content of the pasture, brought about by the extra nitrogen made available by the clover. Stock prefer paddocks topdressed with potash and many instances have been recorded where production has increased after paddocks have been treated.



Liquid manuring builds up fertility.

In Matamata and Piako Counties newly developed areas, excluding peaty soils, do not require potash until the phosphate and lime status of the soil has been built up, and about 15 years usually elapse before potash becomes necessary.

Organic Manures

Organic fertilisers are suitable for topdressing pastures, but the presence in the sward of a vigorous type of white clover amply manured and limed makes unnecessary the purchase of any organic fertiliser that contains nitrogen, the most expensive yet the most easily obtained plant food.

Nitrogenous Manures

It should not be necessary to use nitrogenous manures for pastures; nor can their general use be recommended, except for the production of winter grass on fields in good heart. Nitrolime, nitrochalk, nitrate of soda, and sulphate of ammonia are the main nitrogenous manures, and an application of 1cwt. per acre in July is recommended if it appears that feed may become short before normal spring growth commences. Quick-acting phosphates such as "super. compound" or serpentine superphosphate should be applied at the same time.

Trace Elements

Parts of these counties require the application of trace elements, not so much to increase the growth of the grasses and clovers as to maintain or improve the health of stock depasturing on them. On some of the sandy loams and particularly the pumice soils there is a deficiency of cobalt, an element without which the rearing of young stock is practically impossible. Where known deficiencies exist the use of a cobaltised fertiliser or the application of 5oz. of cobalt per acre per year will allow normal farming operations to be carried on. Land bordering known cobalt-deficient areas is usually topdressed with a cobaltised manure every third year as an insurance against unthrifty stock. In these areas any unthriftiness in young stock should be regarded with suspicion, and cobalt supplied to the pastures will probably remedy the trouble.

Peaty soils of this district have a known copper deficiency, which causes general debility of both old and young stock, the trouble usually being designated as peat scours. The application of copper sulphate (bluestone) to the pastures at the rate of 5lb. per acre per year or the use of copperised manures eliminates the deficiency and restores stock to normal health.

Only on a small area on the banks of the Waihou River near Putaruru has a deficiency of both copper and cobalt been discovered. No other trace elements are known to be deficient in these two counties and the use of a mineral topdressing mixture to supply other trace elements is not necessary. However, when swedes are grown, the prior application of 10lb. of borax per acre is necessary to prevent brown heart.

Liquid Manuring

One has only to compare the fertility of night paddocks with that of paddocks at the back of the farm, from which fertility has been transferred by stock, to realise the value of stock voidings in maintaining and improving a sward. Liquid manure or shed washings should be used to improve the pastures instead, as often happens, of being run into a creek or drain, or the solids allowed to accumulate near the shed, when plant food in them is leached out by every shower. Approximately 1 acre of a farm per year can be topdressed with liquid manure for every 3 cows milked. To use the manure most profitably it is recommended that the spring collections should be put on fields to be closed for hay or silage and the summer and autumn lots should be reserved for building up the fertility of paddocks to be closed in autumn for feeding off in spring. In this way paddocks subjected to heavy withdrawals are recompensed considerably. This factor in pasture management is the subject of Bulletin 256, "Liquid Manure", which can be obtained free from the nearest office of the Department of Agriculture.

Liming

The soils of the Waikato vary considerably in their lime requirements. On the pumice soils of the Tokoroa district no lime responses have been recorded, and on the Maungakawa Hills to the north-west of Morrinsville up to 2 tons per acre are required. On the peaty loams of the Piako County an application of 1 ton per acre followed annually with 4 or 5cwt. per acre gives the best results. The heavy initial dressing improves the soil, but after a year some of the lime has been leached from the soil and its replacement by the lighter, annual dressings maintains the improvement.

With the exception of the hilly country between Matamata and Cambridge, where an initial dressing of 10cwt. per acre is required, the sandy soils of the Matamata County are not highly lime responsive and an annual application of 3cwt. is all that is needed. The cost of spreading this amount can be reduced by treating half the farm in alternate years with 6cwt. per acre.

Lime is not a cure for rushes or other plants of undrained soils, but after the removal of the excess water by drainage, it improves the physical properties of the soil, making it easier to work down to a fine seed-bed for crops or grass. Except on pumice soils, clover species will thrive only in the presence of lime, and as clover is the most important element in the sward, the use of sufficient lime on the areas outlined above is necessary to good pasture production.

Lime may be applied at any time of year with equal results, but if it is not applied with the fertiliser, it should preferably be used before it.

Where raw peat is being brought into production 1 ton of lime should be ploughed down and a second ton applied to the furrow and disced in, as on this soil type lime does not penetrate to the lower layers; hence root development is restricted to the top 1 or 2in. of soil, where, after a short dry spell, insufficient moisture is present to maintain growth.

Hay and Silage

Conserving of excess grass as hay and silage is necessary for the control and care of pastures. The main points to be considered are:—

Cut crops not later than the early flowering stage.

Harvest fields in rotation.

Feed out hay or silage on the field from which it was made or on a poorer part of the farm.

Give silage paddocks an extra topdressing with phosphate immediately they are harvested.

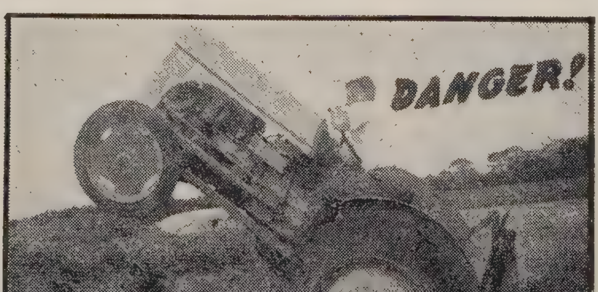
Do not harvest newly sown areas.

Full Utilisation of High Production

In the Waikato, as elsewhere, good grassland farming involves not only the production of the maximum possible amount of herbage, but the conversion of as large a proportion of it as possible into animal products. High pasture production is based largely on the use of Certified seeds and the regular application of fertilisers, particularly phosphate and potash.

Directly associated with high production is full utilisation. The more fully pasture growth is utilised the greater is the return by the animal of the valuable phosphate, potash, and nitrogen. This full utilisation can be secured by grazing as much of the pasture growth as possible and converting the rest into hay or silage for use in periods of shortage.

The presence of acres of waving grass seed heads in summer does not indicate full utilisation. Incomplete utilisation reduces very considerably the value of ancillary operations such as the erection of shelter belts, attention to drainage, weed and pest control, and the provision of ample water for stock.



THE buckrake has now become very popular with farmers who make silage, but where it is used to build mushroom-shaped stacks there is a danger that as the loaded tractor is being driven forward up on to the stack the extra weight on the rear will cause the front wheels to lift, and unless the driver acts quickly, the tractor can rise to a point where it may topple to either side and crush him.

Although it may be considered that the buckrake will prevent it from turning over completely, the tractor's wheels are not on firm ground and the newly built silage stack can easily give enough to allow the tractor to roll and trap the driver.

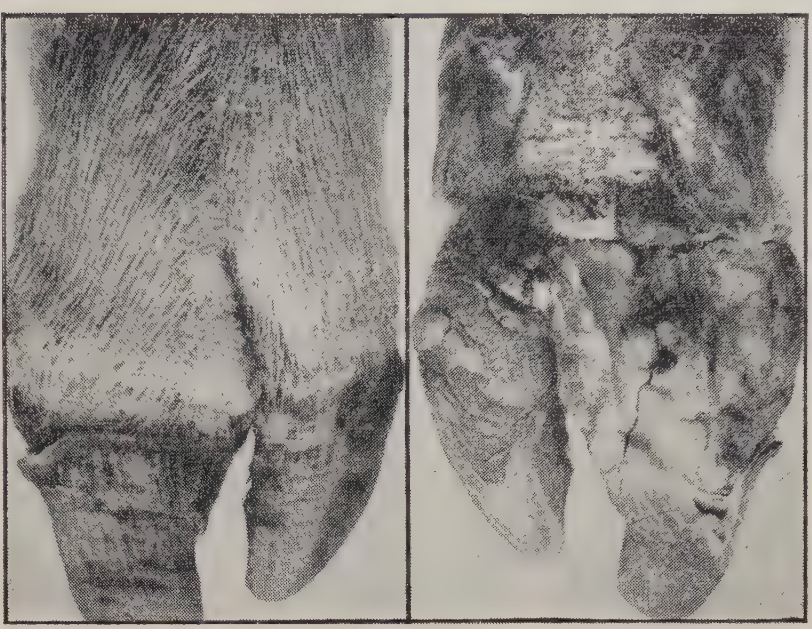
The only way to avoid this danger is to reverse the loaded tractor up the slope on to the stack.

—D. F. SCOTT, Farm Machinery Instructor,
Department of Agriculture, Auckland

Foot-rot, Necrotic Ulcers and Jaws, and Schirrous Cords in Pigs

By C. R. ENSOR, Veterinarian, Department of Agriculture, Whangarei

LOSSES in pigs from foot-rot, necrotic ulcers and jaws, and schirrous cords constitute one of the major financial losses from disease in the pig industry. Farmers should not allow them to occur, as usually affected pigs can be cured easily and quickly.



Foot-rot in a pig, showing a typical crack in a hoof.

FOOT-ROT develops quickly, necrotic ulcers spread to a size of a saucer within a week, and schirrous cords in recently castrated pigs can develop at the same rate. Thus, to the farmer these diseases may appear unnecessarily alarming and because of the rapid growth and repulsiveness of the infected areas, pigs are often destroyed instead of being treated. A pig destroyed on the farm is of no value.

All these diseases are caused by the same group of organisms and are really the same disease affecting different parts of the body. The response to the infection varies according to the area affected. In each case there has to be an injury to the hoof, skin, or mucous membrane through which the infection can enter. If any of this group of diseases is present in a piggery, any of the others may be expected and indeed it is common to find pigs affected with necrotic ulcers, foot-rot, and schirrous cords in the same piggery.

Foot-rot

Foot-rot is most common in pigs from 3 to 6 months old which are being fattened for bacon, but it may be seen in weaners, boars, or sows and has occurred even in piglets a week or so old. It usually appears between October and February, the months when most pigs are being fattened, a period which seems to coincide with the best environmental conditions for the causative organisms.

The incidence may vary from one or two affected pigs each year to over 50 per cent., but the latter rate occurs in only a few piggeries. It was estimated that for the 1949-50 season the number of pigs in Northland infected with foot-rot was 1200 or just under 2 per cent.

The first indications of foot-rot are that a pig is seen lame or carrying a leg. Careful examination of the foot should be made to determine whether the lameness is due to a simple injury or to foot-rot. Foot-rot infection is usually in the outer digit of either a fore or hind foot. When the affected foot has been cleaned there is usually to be seen a crack or black mark under the wall of the hoof, running up from the sole toward the coronet. These cracks usually extend about two-thirds of the way from the toe round toward the heel and are fairly common on pigs' feet. Not every crack gives rise to foot-rot, as this develops only when a crack becomes infected with foot-rot organisms.

Pigs' Feet Worn by Concrete

Though pigs that are tender on their feet but that have no foot-rot infection are seen quite often in concrete-floored sties, most cases of foot-rot occur in pigs kept in sties with concrete floors. This is because the pigs' feet are worn down by the concrete to such an extent that they are easily injured by rough metal, nails, or old iron. Also, when feet are worn down there is less strength in the sole-wall junctions, so that when pressure is applied to a foot (from the weight of the pig, especially when fighting for food at the trough) there may be slight separation of the sole-wall junction, thus allowing the entry of infection into the foot. When the separation closes again the organisms are able to multiply within the hoof and work up the soft tissue under the horn of the wall to the coronet. This path of infection appears as a dark line under the wall of the hoof.

As the infection spreads up above the coronet the digit becomes very swollen, due to the fibrous tissue formed as a reaction to the infection, and there will be one or more outlets breaking through the skin to the outside. This firm swelling due to the excessive amount of fibrous tissue formed is characteristic of foot-rot in pigs. There is not very much discharge from the outlets.

Foot-rot is not fatal, but as it produces a very severe lameness, pigs lose condition rapidly. If left untreated, the pig soon becomes uneconomic and can only be destroyed. If foot-rot is treated early, the lameness disappears in a few days and the pig's growth is almost uninterrupted.

Necrotic Ulcers

Necrotic ulcers are lesions occurring on legs, bodies, and heads of pigs. The lesions are characterised by rapid growth and spread to healthy skin around them. They are usually shallow, except on the head, where they may extend into the deeper tissues rather than over the surface tissues, and there is only a slight discharge. Outlets are not very common, except on the legs.

If left untreated, lesions on the body spread, leaving an area denuded of skin, with underlying muscles exposed. Secondary infection may then start further infection. Lesions on the legs are often accompanied by hard swellings caused by the formation of fibrous tissue as in foot-rot. Untreated lesions on the head may extend to involve the deeper tissues and if adjacent to the eye, may affect that organ, causing blindness and eroding the tissues until the structures of the eye have disappeared.

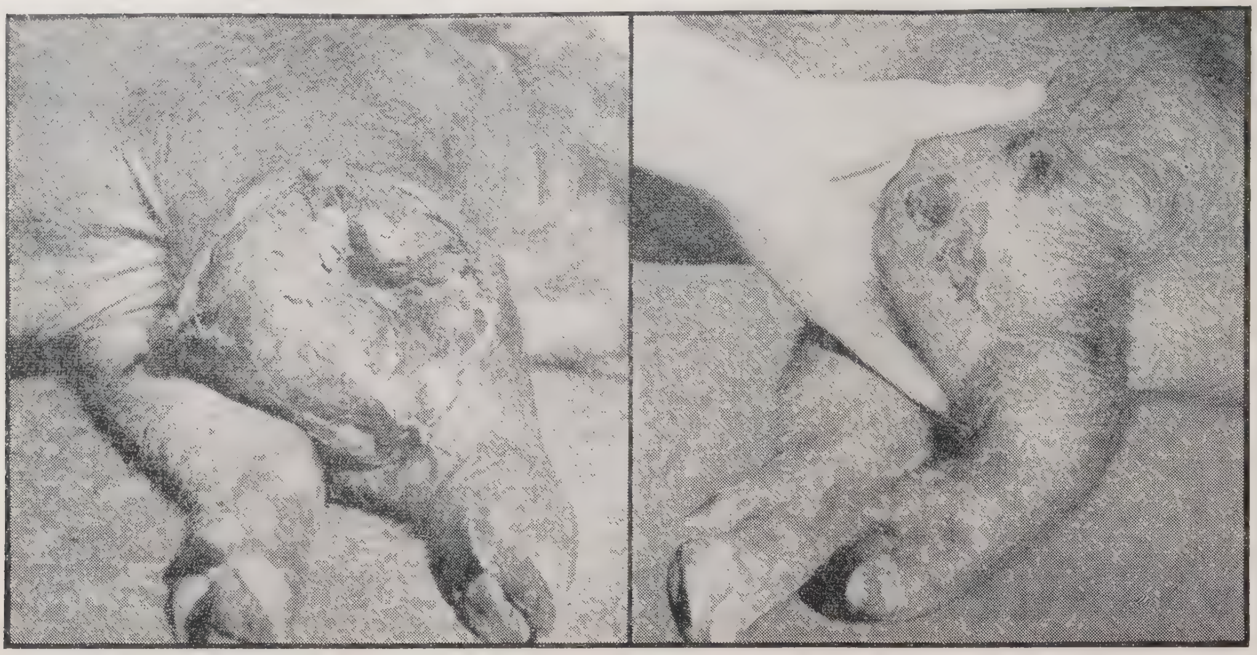
Lesions on the jaws, which resemble necrotic jaws in baby pigs, will be described later.

Necrotic ulcers may spread until the pig has to be destroyed on humane grounds or because of loss of condition.

If lesions are treated, especially in the early stages, pigs should recover very quickly and no losses should occur.

Necrotic Jaws

Although older pigs may become infected around the teeth, necrotic jaws are more common in sucking pigs, sometimes only a week or two old, and usually the whole litter is affected at the same time. When such an infection breaks out in a litter it will often be found that the sow has a necrotic ulcer, sometimes involving the mammary glands. The baby pigs pick up the infection through breaks



Left—Necrotic ulcer before treatment with sulphanilamide powder. Right—The same ulcer a month after treatment, showing effect of daily dusting with sulphanilamide powder.

in the mucous membrane lining the mouth, usually around the teeth. Necrotic lesions develop quickly on the jaws and spread to the lips, eating away the tissues. Affected baby pigs soon lose condition, become rough coated and hump backed, and eventually starve to death because their mouths are too painful for them to feed. These pigs also can be treated successfully if the disease is recognised in time.

Schirrous Cords

If proper precautions are not taken when pigs are castrated, infection may enter the wounds through being introduced on the knife or from contaminated surroundings soon after the operation.

In the early stages of a case the scrotum is swollen, firm, and with an outlet which has a slight discharge. The outlet may heal over, but the swelling increases until at the end of 3 weeks it may be about 6in. in diameter. This swelling is hard, fibrous tissue formed as a body reaction to the particular type of infection. The pig continues to grow despite the swelling, but not nearly as quickly as its litter mates, until the swelling becomes so large that movement is impeded. The pig then has to be destroyed. These fibrous swellings can be removed surgically, but it is far easier to treat an infected pig in the early stages. Even small swellings may cause condemnation of the carcass at the works under the heading of "faulty castration".

Prevention of Diseases

Prevention of the diseases described should follow two lines:—

1. **Prevention of injury to pigs and so prevention of entry of infective organisms to the body:** Regular inspection of walls and floors of piggeries should be carried out to make sure there are no nails or projecting iron on which the pigs can injure themselves. Old tins, iron, and wood with nails protruding should be removed from piggery surroundings. Tracks into piggeries should be kept free of rough, sharp stones. Barbed wire, although some farmers consider it necessary for the construction of yards. is a common cause of injury and should never be used for pig yards, except perhaps for the bottom wire.

Where foot-rot is experienced on concrete floors pigs should have access to pasture as much as possible to reduce the amount of wear on their feet. Trials in the 1948-49 season to compare the incidence of foot-rot on wooden and concrete floors showed that the incidence was much lower on wooden floors. In the 1950-51 season a rubber floor was laid in one of the badly infected piggeries, but unfortunately small metal chips were included in the rubber-cement finish. The onset of foot-rot in this pen was only delayed, the total incidence being almost as high as on concrete. The rubber cement has not stood up to the conditions as well as was expected, so it cannot be recommended as a flooring.

This season (1951-52) a type of bitumin floor is being tried, but it is too early yet for any report to be given. Biting dogs and savage pigs which may cause injuries are also to be avoided.

2. **Prevention of spread of infective organisms:** The first rule is to avoid buying pigs, so that disease is not introduced into the piggery. As far as possible farmers should breed all their own stock, but if they have to buy pigs, they should purchase only from piggeries free from infection and never from saleyards. All infected pigs should be treated, so that the piggery is contaminated as little as possible. Infected pigs should be isolated until they are cured.

Good hygiene should be practised—dunging races and sleeping quarters should be kept clean and sunlight should be allowed to reach right inside the pig sty, so that every part of the sty is kept as dry as possible. Chemical disinfection of piggeries may help, but this alone will not eliminate infection. A copper sulphate footbath has been used successfully at the Department of Agriculture Animal Research Station, Ruakura, to prevent foot-rot.

Treatment

Tartar emetic (a poison), sulphanilamide powder, sulphamezathine solution, or penicillin all may be used for treatment of the diseases. The cheapest treatment is by using one of the powders, and sulphanilamide is recommended because it is non-poisonous if used in the prescribed manner. Tartar emetic may cause death if spilt in the yard and eaten by pigs or if used round their mouths. The powders are recommended only for necrotic ulcers, and even some cases of necrotic skin ulcers are best treated by injection.

Sulphamezathine or penicillin are both given by injection and should be used only by a veterinary surgeon or on his advice. These two drugs both give excellent results. Penicillin is the easier to give and could be used by any farmer who has had proper instruction in its use.

All these drugs (except tartar emetic) can be obtained only from or on a prescription from a veterinary surgeon, so whenever possible a veterinary surgeon, who will be able to advise the most suitable treatment, should be consulted.

Onion Growing in the Pukekohe District

By T. C. R. DAWE, Horticultural Instructor, Department of Agriculture, Pukekohe

ONE of the main vegetable crops of the Pukekohe district, onions are grown in market gardens and to some extent on mixed farms. The major part of the annual crop of about 500 acres is grown to maturity, but in seasons when stored onions are scarce green onions are harvested for market in December and January. Mature crops are harvested from February to April, some being stored on the farms in sheds, others held in cool storage, and the balance marketed immediately. These methods contribute to continuity of supply. In general the climate of the district is ideal for the production of good keeping bulbs, the weather in February and March of most years being admirably suited for the harvesting and drying of well-grown onions.

THOUGH onions are reasonably easy to grow, complete success can be obtained only by good cultural and manurial methods. At all times suppression of weeds is of major importance.

Before 1940 some 3000 tons of onions were imported into New Zealand annually. Not only does the industry now produce sufficient for New Zealand needs, but a profitable export trade is being built up. Sufficient suitable land is available in the Pukekohe district to allow production to be increased by at least a quarter.

Selection of Site

Well-drained medium to heavy loams have proved very satisfactory for the production of good-quality onions. Land previously under cultivation is preferred to newly broken-up pasture. Sheltered positions are not recommended, as they tend to produce conditions which favour the increase of mildew, and exposure to wind is of considerable assistance in the drying and curing of bulbs at harvest time.

Onions require cool conditions in their early growing stages and can withstand several degrees of frost. Moderate to high temperatures and long exposure to light are required for good bulb formation. As the main cultural problem is weed control, some growers use the same area for several years, rotating onions with potatoes.

Preparation of Land

To facilitate weed control preparation of the land should be started some time before planting or sowing. The initial ploughing should be reasonably deep, the depth being governed by the type of soil; heavy types should not be ploughed as deeply as the lighter soils, and at Pukekohe it has been found undesirable to bring subsoil to the surface, as reducing it to a fine tilth is always difficult.

To bring the soil to a fine tilth several strokes with disc harrows and tine harrows are usually given after ploughing, and the seed-bed is firmed with a board leveller where a roller cannot be used. Rollers are seldom used in this district, as they over-consolidate the soil, causing cracking in dry weather.

[Photo above by My Bonnie Studios; below by Sparrow Industrial Pictures.

Planting out onions grown in seed-beds.

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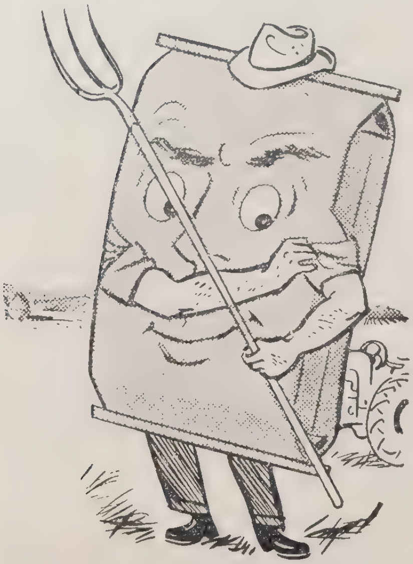

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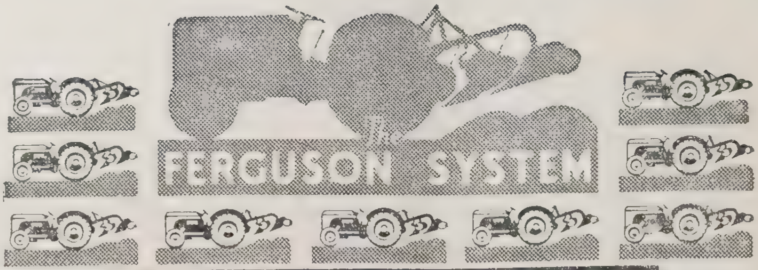

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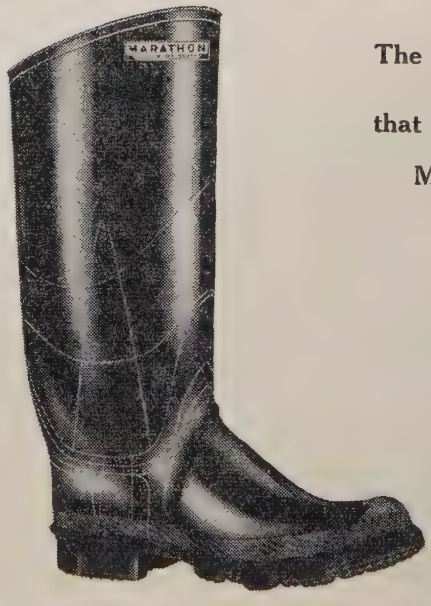

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Most Pukekohe growers apply up to 1 ton per acre of lime annually about a month before planting or seeding the crop and harrow it into the topsoil. About 2 weeks before the planting or sowing it is usual to apply 20 to 25cwt. per acre of bonedust or bone flour, to which is often added 1 to 2cwt. of sulphate or muriate of potash and up to 1cwt. of sulphate of ammonia.

Planting and Sowing

The seed is either sown in seed-beds and the young plants transplanted or sown directly into the field.

For the first method the seed is sown thickly (1oz. to 1 chain of row) in rows 12in. apart during March or April in a seed-bed in an open, sunny position. The plants are transplanted into the field from June onward, by which time they are about 6 to 8in. high and of pencil thickness. Before the plants are set out the roots and tops are trimmed. Planting is done by hand in rows 1ft. apart with 4 to 5 plants per foot of row. Transplanted onions mature early and are ready for harvesting in January or February. Because their keeping quality is not always good they are seldom stored, but usually are marketed immediately.

[*Sparrow Industrial Pictures Ltd. photo.*

A 6-row mechanical onion seeder in operation.

Hand weeding seedling onions.

The more favoured method is to sow the seed thinly directly into the field during August or early September in rows 12 to 14in. apart. Seeding is generally carried out with single or multiple mechanical seeders to a depth of ½in., 4lb. of seed being considered sufficient to sow an acre under ordinary conditions. Thinning of the plants is seldom necessary. Most of the crop grown thus is stored for later use.

Planting or sowing before the recommended times often results in the production of bulbs with seed stems and thick necks.

Speed of germination is important to the production of healthy, vigorous onion plants and the use of recently harvested plump seed is very desirable. Under normal conditions the viability falls rapidly after the second year of storage. A simple germination test conducted by setting seed on moist blotting paper or flannel for a few days will often save heavy field loss incurred through use of inferior or old seed. Seed is best stored in dry, airtight containers in cool conditions.

Dusting with a good proprietary fungicide assists in reducing pre-emergence damping off to a minimum.

When the seed germinates the primary root emerges from the seed coat first, soon followed by the secondary roots, which should anchor the young plant firmly in the soil. The leaves do not emerge as such until later; their release follows the straightening of the hook-shaped shoot they form and the casting off of the old seed coat.

Varieties best suited to the Pukekohe district are Early Straw, for harvesting in December and January, and Pukekohe Long Keeper, which is harvested during March and April and marketed during winter and spring.

Pests and Diseases

Onions are less subject to disease than many other vegetable crops, and with good garden hygiene the pests and diseases which do attack them can be controlled satisfactorily.

[*Sparrow Industrial Pictures Ltd. photo.*

A mechanical cultivator of the type used on a growing onion crop.

Onion mildew (*Peronospora destructor*) is a serious disease which spreads rapidly in the field under favourable conditions. On occasions it has caused considerable losses during storage. Cool, moist weather and fields sheltered from wind favour development of the fungus, which appears on the leaves as pale spots; these may gradually spread over the plant, causing it to wither and, when severely attacked, eventually to die. Unless precautions are taken whole beds of seedlings may be destroyed by mildew. The disease is wind borne, and plants may be attacked at any time during growth if temperatures and humidity are favourable.

A reasonable degree of control of mildew is achieved by frequent applications of Bordeaux mixture 4 : 5 : 50, plus 4oz. of a wetting agent and 2 pints of summer oil to 50 gallons. Keeping a spray coverage on plants in the seed-bed from emergence until the plants are set out in the field has been found essential.

Thrips (*Thrips tabaci*) cause considerable damage to onion crops in the Pukekohe district. Until recent seasons little spraying to control thrips has been done, but this pest is increasing rapidly in numbers and control measures will need to be applied more widely. This species of thrips has not proved easy to control in Pukekohe, but the most promising materials used against them are D.D.T. and hexaethyl tetraphosphate.

Cultivation

Cultivation and weeding by hand or by mechanical units are begun as soon as the seedlings appear above ground and continued at intervals until the plants are too large to be worked among without the bulbs being damaged. Hand weeding is necessary on occasions, but if the initial cultivation of the field has been thorough mechanical weeders usually give sufficient control.

[*My Bonnie Studios Ltd. photo.*

Onions being topped and turned while lying in the field to dry and cure.

[*My Bonnie Studios Ltd. photo.*

A mature crop of onions being wheel hoed preparatory to being raked into windrows.

Selective chemical weedicides such as sulphuric acid and dinitro preparations, which assist in keeping the crop weed free at a comparatively low cost, are a useful supplementary control method under suitable conditions. Sulphuric acid (1.67 specific gravity) at a concentration in water of from 7½ to 10 per cent. has given satisfactory control of weeds when the onion plants are small; it is applied to transplanted crops as soon as the plants have rooted well and to seedling crops when the plants are from 3 to 4in. high. Dinitro preparations have proved less successful than sulphuric acid sprays in this district; they are slower in action and, if applications are followed by showery weather, their effectiveness is greatly reduced.

Harvesting

When the bulbs have reached maturity (usually 6 to 7 months from planting or sowing) a wheel hoe or skimmer is run under the bulbs sufficiently deep to avoid damage to the onions. The bulbs are then raked into windrows, each made up of 3 or 4 rows, and left for some weeks to dry and cure. They are raked over or turned several times during that period.

When they are sufficiently dry the bulbs are topped or trimmed and then left in the field for several days for further drying, after which they are graded, bagged, and marketed or stored. Two grades are packed, fair average quality and pickler onions.

Some growers have mechanical toppers and graders, but the majority employ labour, though the cost is encouraging growers to mechanise.

Storing

Most growers and merchants in the Pukekohe district store onions. Growers use well-ventilated sheds on the farms, placing the bulbs in crates or banana cases, where they keep well when stored under darkened conditions.

Merchants use sheds or cool stores. Well-seasoned onions held in ventilated cool stores at 32 to 34 degrees F. and more or less in darkness keep satisfactorily for up to 7 months.

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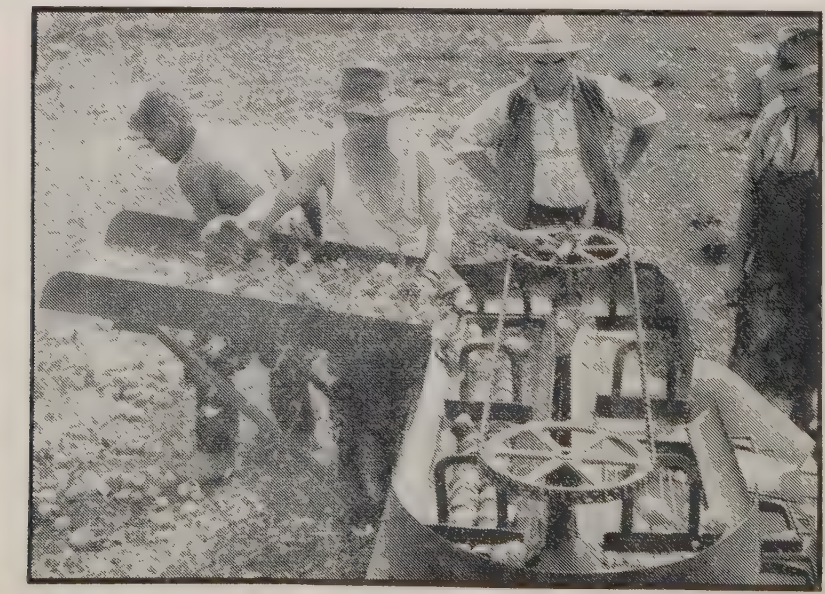


[*My Bonnie Studios Ltd. photo.*

A mechanical topping and grading unit such as some Pukekohe onion growers have invested in to reduce labour costs.

Sowing in the Home Garden Can be Begun in July in Mild Districts

By C. L. NAPIER, Horticultural Instructor, Department of Agriculture, Hastings

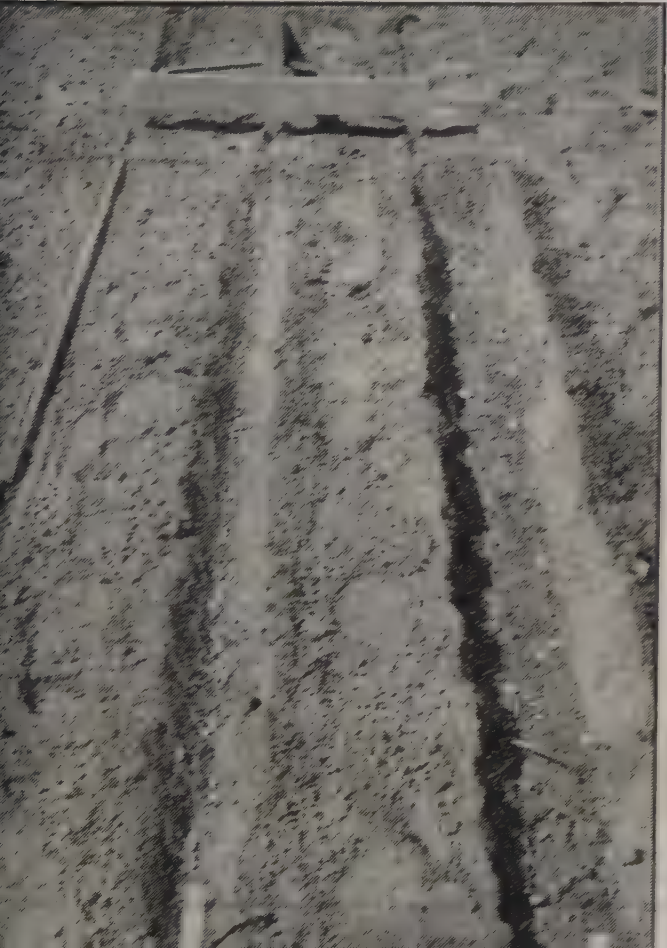
IN the warmer districts of the north gardeners will be able to begin seed sowing in July for spring and summer crops, but in many other districts caution will have to be exercised. Frames and cloches are valuable aids in raising early seedlings in the less favoured localities and with them gardeners may gain some weeks in the production of certain vegetables. However, unless soil and weather conditions are suitable for sowing (or favourable conditions can be created) and seed is sown at the correct depth, much effort taken at this time of year will not be rewarded.

EARLY-SOWN crops in the home garden often fail and in many instances the trouble can be traced to the over-zealousness of the gardener. In an effort to obtain early crops of say peas, beans, potatoes, and cucurbits he overlooks the importance of good growing conditions. Consequently, much loss results through poor conditions and the depredations of soil-borne fungi and insects.

Vegetables must get a good start. Favourable conditions encourage better and quicker germination, more rapid growth and earlier maturity of crops.

Warmth, Moisture, and Air

Seeds are dormant living plants. Warmth is important, as it acts as a catalyst or an agent for encouraging growth of the embryo plant. The best range of temperatures for germination is 60 to 70 degrees F., and if the temperature is lower, seeds may remain dormant and possibly rot in the soil. High temperatures are also dangerous, as they can destroy the seed or cause it to go into a state of secondary dormancy.



Above—When soil conditions are not good peas can be sown shallowly and the soil moulded up when the drill is filled in. At left—Small seeds can be sown in shallow drills made by pressing a rake handle into the soil (left). A drill made with the edge of a draw hoe blade (middle) is suitable for medium seeds. A drill drawn with the full edge of a hoe (right) is better for large seeds such as those of broad beans. The marker in the background is valuable for quick marking of rows.

Soil water affects soil temperature and an excess of it as in winter can reduce the temperature below that suitable for germination of seeds. Excess water also encourages certain micro-organisms to attack the seeds, thus reducing germination percentage. Water, however, is necessary, as it holds plant foods in solution, the only form in which the germinating plants can assimilate them. Excess water will exclude air, the oxygen of which is vital to most organisms.

Air can be reduced or excluded from sown seeds by excess water, by too great a depth of sowing, particularly on heavy soils, and by packing the soil too tightly after sowing.

Other factors governing the germination of seeds are light and the age and stage of maturity of seeds. Light probably does not play a very great part, but it is generally believed that better germination results when light is excluded. Age of seeds definitely affects germination. A seed even when not growing is breathing and gradually using up the food stored within the seed coat. If seeds are stored too long their embryos may die or weaken through lack of food. Immature seed does not give good germination, mainly because the embryos have not developed sufficiently or because insufficient food has been stored to allow satisfactory resumption of growth when seeds are sown.

Photographs on this page by R. W. Orr.

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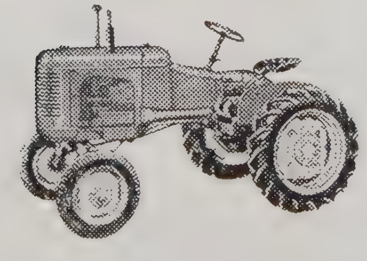

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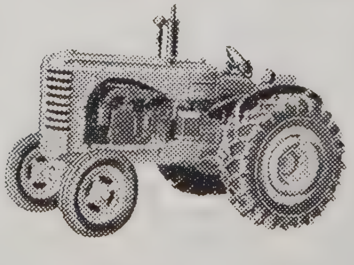

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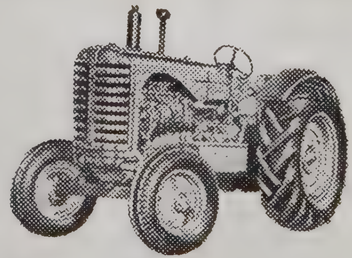

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Value of Good Seed-bed

If sufficient warmth, air, and moisture are present, seed will germinate; soil is therefore unnecessary, but if subsequent growth is to be satisfactory, food must be available. Soil of good texture and food content is the most satisfactory sowing medium. It also holds adequate moisture, but provides good drainage and aeration, both of which assist in maintaining satisfactory soil temperatures.

To assist in maintaining satisfactory conditions during the wettest periods of the year seed-beds or garden plots can be raised. This will assist drainage and the maintaining of higher soil temperatures than when the plots or beds are on the flat. Built-up beds should be watched in summer, as drying out can easily occur.

Seed-sowing soil, whether in beds or boxes, should be in a fine, friable condition. Large particles of soil tend to lose moisture easily and do not pack closely enough to supply the necessary moisture to seeds. A loose soil can also be troublesome, and all seed-beds should therefore be firmed before sowing. Most topping soils can be firmed gently; this applies particularly to the lighter or sandier types. Excessive consolidation of heavy or clay types of soils can lead to poor germination, as air may be excluded, and carbon dioxide given off by the germinating seeds is unable to diffuse into the soil. Possible poisoning and death of the young plants can result.

Very loose soil does not provide a satisfactory foothold for young roots, and if the soil is full of large air pockets, the roots may be unable to obtain the necessary foods. Over-packed soil can lead to the young plant finding difficulty in making its way to the surface of the soil, thus causing deformity and poor growth.

Light or sandy soils are valuable in spring and early summer and, providing the moisture content is right, they tend to warm up more quickly than other types, thus encouraging earlier and quicker germination.

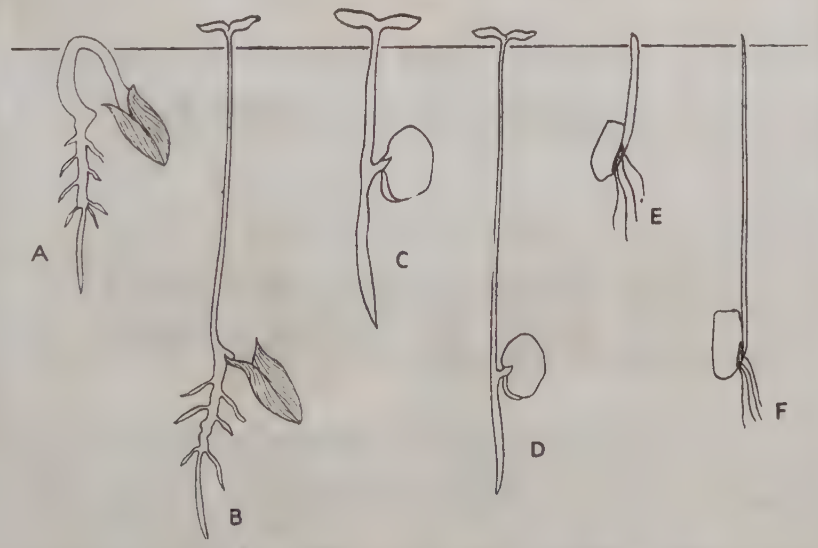
If satisfactory growth is expected, food must be available for the young plants. A soil rich in organic matter is best, but alternatively manufactured fertilisers can be added. Organic matter should be broken down and well mixed with the soil before seed sowing begins. However, well-matured compost is satisfactory for putting in drills close to the seed. The breaking down of organic matter and fertilisers such as sulphate of ammonia, dried blood, nitrate of soda, blood and bone, and potash can cause the build up of soluble salts, ammonia, and carbon dioxide in such quantity that germination can be reduced seriously. It is therefore recommended that fertilisers should not be applied in the drill with the seed; it is best to mix them with the soil or to apply them below the drill before sowing.

Deep Sowing Hinders Germination

In nature, few seeds buried deeply germinate. Ploughing or deep digging of land usually encourages the germination of many seeds of plants not known to be there. Both these examples demonstrate that no great depth of sowing is necessary and that sowing too deeply delays or prevents germination. Seed sown too deeply is denied air and warmth, it may be in contact with too much moisture, or it may be weakened during the longer time necessary for the seed leaves to reach the surface. This weakening is brought about by the necessity for the plant to draw food from the seed for maintenance until the young leaves emerge and the manufacture of food supplies can take place.

Sowing too shallowly also can inhibit germination. With shallow sowing the greatest danger is the drying out of the soil; if seeds germinate and the soil becomes dry, the tender seedlings may suffer from lack of moisture.

However, summer sowing or sowing in light soils may of necessity have to be deeper than sowings in spring or on heavier soils. In the former two instances drying out can occur if precautions are not taken.



If seed is planted too deeply, thin, weak shoots which are easily killed under adverse conditions develop. Seedlings shown escaping from their seed coats are: A and B—Pumpkin. C and D—Beans. E and F—Sweet corn. A, C, and E, planted at suitable depths, are making strong growth. B, D, and F, planted too deeply, show the weakening effect due to depletion of food reserves contained in the seed coat.

Seed Testing

Most home gardeners store from year to year part packets of various vegetable seeds and these eventually may accumulate for several seasons. Doubt is often expressed as to the viability (ability to grow) of this seed and consequently it may be wasted. Such seed can be tested very easily and quickly and if the percentage of germination is low, the rate of sowing can be increased.

A simple method of testing seed is to arrange 10 rows of 10 seeds on a piece of damp flannel or blotting paper. The seeds can be covered with similar material, placed in a shallow dish such as a saucer, and covered with an inverted dish to reduce moisture loss by evaporation. Germination should take only a few days. A germination count can then be made.

Seed Treatment

Seed protectants are fungicides which can be applied to seeds before sowing to reduce attacks by soil-borne fungi. Seed protectants are being used increasingly for field-grown crops such as peas and beans. However, they are valuable also where seeds are being sown in boxes. Their value is enhanced when sterilisation of the soil cannot be done, but they should not replace sterilisation. The most common fungi whose development is inhibited by seed protectants are those species causing damping off.

Seed treatment can also include immersion in hot water or treatment by acid. Acid treatment of tomato seed destroys certain virus and bacterial diseases which may carry over from season to season on the seed coat and which are unaffected by soil sterilisation. Where there have been repeated failures through the occurrence of damping-off fungi and other seed-destroying organisms gardeners should consider seed treatment.

APPROXIMATE SOWING DEPTHS

The following table of sowing depths for vegetable seeds is given as a guide only and gardeners should sow according to local soil, climatic, and seasonal conditions.

Up to ¼in.

Celery
Lettuce
Radish
Tomato

¼in. to ½in.

Asparagus
Beetroot
Brassicas
Carrot
Leek
Onion
Parsnip

½in. to 1in.

Cucumber
Marrow
Melon
Pumpkin
Silver beet
Spinach
Squash

1in. to 2in.

Beans (broad, French, and climbing)
Peas
Sweet corn

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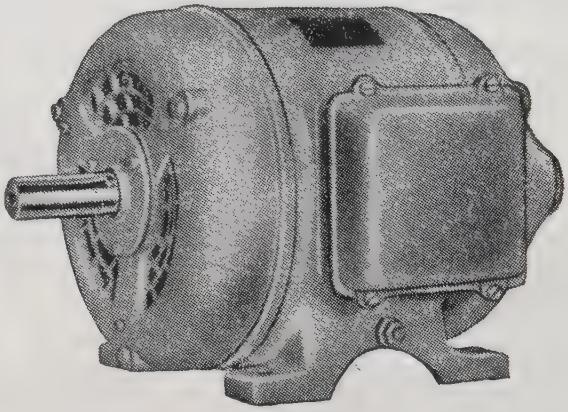

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Treatments which have been found most effective against parasitic fungi and bacteria include:—

Dusting seed with a fungicidal dust.

Steeping seed in a fungicidal solution (including acid).

Steeping seed in hot water.

Dusts used can be metallic compounds such as copper carbonate or copper oxychloride, compounds such as organic mercury, and certain non-metallic compounds.

The following suggestions are made for the treatment of vegetable seeds. In all cases seed should be treated carefully and where proprietary compounds are used the makers' recommendations should be followed.

Copper Compounds

Copper compounds can be used for bean, beetroot, carrot, cucumber, lettuce, pea, spinach, silver beet, and tomato seed. Seeds with a little of the compound should be shaken in a closed container until the seeds are completely coated. Excess dust should be removed before seed is sown.

Organic Mercury Dusts

Organic mercury compounds are used in the same way as copper compounds for seed of brassicas (includes radish and turnip), beetroot, carrots, cucurbits, spinach, silver beet, tomatoes (does not kill virus diseases), peas, and beans. For the last two a non-metallic dust should be used if seeds are treated with nodule-producing bacteria.

Non-metallic Compounds

Non-metallic compounds include preparations of tetrachloro-parabenzoquinone; 2,3-dichloro-1, 4-naphthoquinone; and tetramethyl thiuram-disulphide. Commercial preparations of some of these therapeutants are certified for the control of pre-emergence damping off of peas. They should be used in a similar manner to copper dusts.

Hot-water Treatment

Hot-water treatment is used mainly for brassica and onion seeds, which should be suspended, preferably in a muslin bag, in a large volume of water (at least 2 gallons) previously heated to 122 degrees F. The temperature should be maintained for as long as the seed is required to remain in the water. Cabbage and onion seed should be immersed for 25 minutes and all other brassicas for 18 minutes. Celery seed, which can also be water treated, is usually immersed in water at 135 degrees F. for 10 minutes. After treatment seed should be spread out in the shade to dry.

Corrosive Sublimate

Corrosive sublimate is used chiefly for potato seed which is unsprouted. It is effective against common scab. Proprietary preparations are obtainable and should be used as specified on the labels. Glass, earthenware, or wooden containers should be used for the treatment. As corrosive sublimate is a deadly poison, it should be kept where children cannot get it.

Zinc Oxide

Zinc oxide is applied in the same way as copper compounds and is useful in treating beetroot, brassicas, carrots, lettuces, onions, parsnips, tomatoes, and spinach. It can usually be obtained from a chemist.

[*R. W. Orr photo.*

A cloche covering an area of 24in. x 23in. is large enough to protect two ordinary-size seed boxes and is easy to shift about the garden.

Acid Treatment

Hydrochloric or glacial acetic acid is used to treat tomato seed and is an effective preventive of some virus and bacterial diseases.

Hydrochloric acid is now used extensively in the extraction of seed. The pulp should be extracted as described on page 51 of the January 1952 issue of the "Journal". Place pulp from 5lb. of fruit in a glass, earthenware, or wooden container and add 1 fl. oz. of commercial acid. Stir frequently for 3 hours and then wash thoroughly with water. Allow the seed to settle, and decant the liquid. Repeat the washing and decanting several times to clean the seed and remove all traces of acid. Spread the seed thinly on paper and dry it quickly. This method not only destroys virus and bacterial diseases, but tends to improve germination.

Where seed of doubtful origin has to be sown glacial acetic acid can be used for the control of possible bacterial diseases on the seed. The seed should be soaked in a 0.6 per cent. solution of the acid for 25 hours and then dried. The seed can then be dust treated as mentioned previously.

Sowing

Seed may be sown in drills where the resultant plants are to grow. This method has many advantages because:—

1. There is no transplanting and therefore no check to plants.

2. Raising of the particular crop can begin some weeks later than otherwise.

3. There may be a saving of time and labour.

4. Crops sown in situ tend to mature more quickly.

Sowing in the open garden should not begin until the soil is in a fit condition to work on. If the ground has been dug recently, some consolidating will be necessary and the packing given while the gardener is preparing it for sowing is usually sufficient. Soil after being worked up is best left for a week or two before seed is sown to allow weed seeds to germinate; weeds can then be removed at the final preparation.

Drills may be drawn conveniently with the corner of a draw hoe blade or with the full blade, depending on the seeds to be sown. A wide drill is suitable for broad bean and pea seeds. Shallow drills for the finer seeds can be drawn with the end of the handle of a hoe or rake; alternatively the handle can be placed on the ground along the line desired and pressed firmly into the soil. The evenness of depth of a drill is important, as any appreciable variation may cause uneven germination. If the soil is dry at sowing, the opened drill can be saturated with water, which should be allowed to soak in well before sowing. A further small amount of water can be applied when the drill is partly closed. The soil returned

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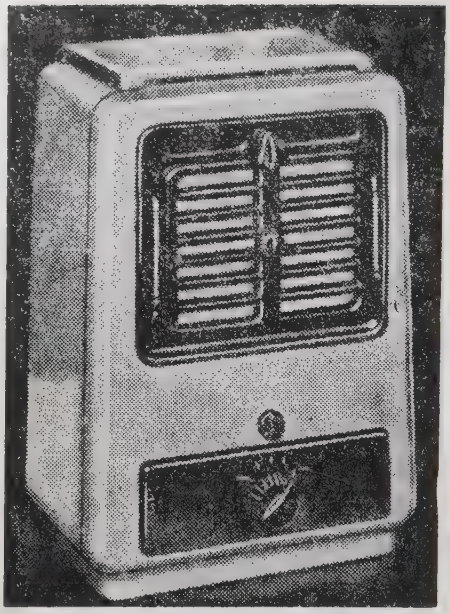

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to the drill should be fine and should be firmed to bring it in contact with the seed. A final shallow raking will remove any large lumps and tend to level off the soil surface.

Where possible rows should run approximately north and south so that the maximum of sunshine will reach between the rows. If rows cannot be laid out in these directions, the tallest plants should be sown on the south side.

If gardeners have not previously sown onions and lettuces (late crops) in open ground instead of transplanting seedlings, they would be wise to consider doing so. Much time is saved and there is no check to plant growth.

Sowing in Beds

Although sowing crops where they are to mature saves time and reduces damage to plants, raising of seedlings in beds for transplanting later has much to commend it. Seedlings can often be raised in a sheltered position for planting out as soon as conditions are favourable, and where plots are not always available for direct sowing of crops it is necessary to raise plants in beds.

Seed raising in beds has not much to commend it from the aspect of the vigour and health of plants produced; the main advantage is that it is convenient. Beds can be constructed in a warm, sheltered corner and the soil should be fine and friable. For convenience and effective control of weeds and diseases and to produce better plants, seed is best sown in drills, not broadcast. With the broadcast method seed is likely to be wasted and sown too thickly and unevenly. The resultant plants may be weak and more susceptible to disease, because of the dense mass of foliage.

Beds about 4ft. wide are convenient and drills can run across them about 6in. apart. If seed is sown thinly, the subsequent plants should be sturdy, weed control will be easy, and the greater air movement among the plants will assist control of disease. The removal of seedlings for planting out is also easier and less damage is likely to be done to roots of the seedlings left.

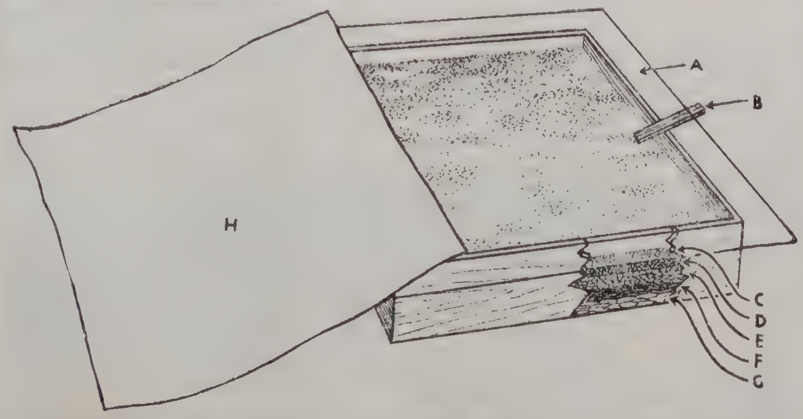
[*Green and Hahn Photography Ltd. photo.*

Seed sown in rows either in boxes or outdoors produces sturdier and healthier plants than seed sown broadcast. Thin sowing in rows also allows plants to be left longer before planting out.

Cloches and Frames

During early spring, when conditions are relatively unfavourable for plant growth, cloches and frames are valuable for seed raising. Barn cloches cover an area of about 24in. by 23in., which is sufficient for the average home garden seed-bed. If the seed-bed is constructed to this size, the cloche will provide valuable shelter and improve soil and air conditions. Placing of cloches over the prepared seed-bed a week or two before sowing allows the soil to be warmed. Cloches can also be placed over seed boxes.

The frame and hot-bed illustrated on page 365 in last month's "Journal" can be used for direct sowing or the housing of seed boxes. If stable manure is used in the construction of the hot-bed, a good layer of soil (about 3in.) is necessary if seed is to be sown directly in the soil. Preparation of soil and sowing should be done in a similar manner to sowing outdoors.



Seed sowing in boxes must be done carefully and this diagram illustrates how the sowing medium should be prepared. A—Glass. B—Peg to lift glass to provide ventilation. C—Very fine soil, necessary only for very fine seeds. D—Fine soil. E—Coarse soil. F—Rough or fibrous soil. G—Leaf mould. H—Paper, which is placed over the glass for the first 2 days and is then removed.

Where glass is used to cover seed-beds or seedlings some form of aerating of the structure once or twice daily is necessary. The glass or lid should be lifted for a few minutes about mid-morning and late afternoon, and all moisture should be wiped from the inside of the glass. Watering under glass must be done carefully, as conditions can easily become too damp, which will readily encourage the establishment of parasitic fungi.

Seed Boxes

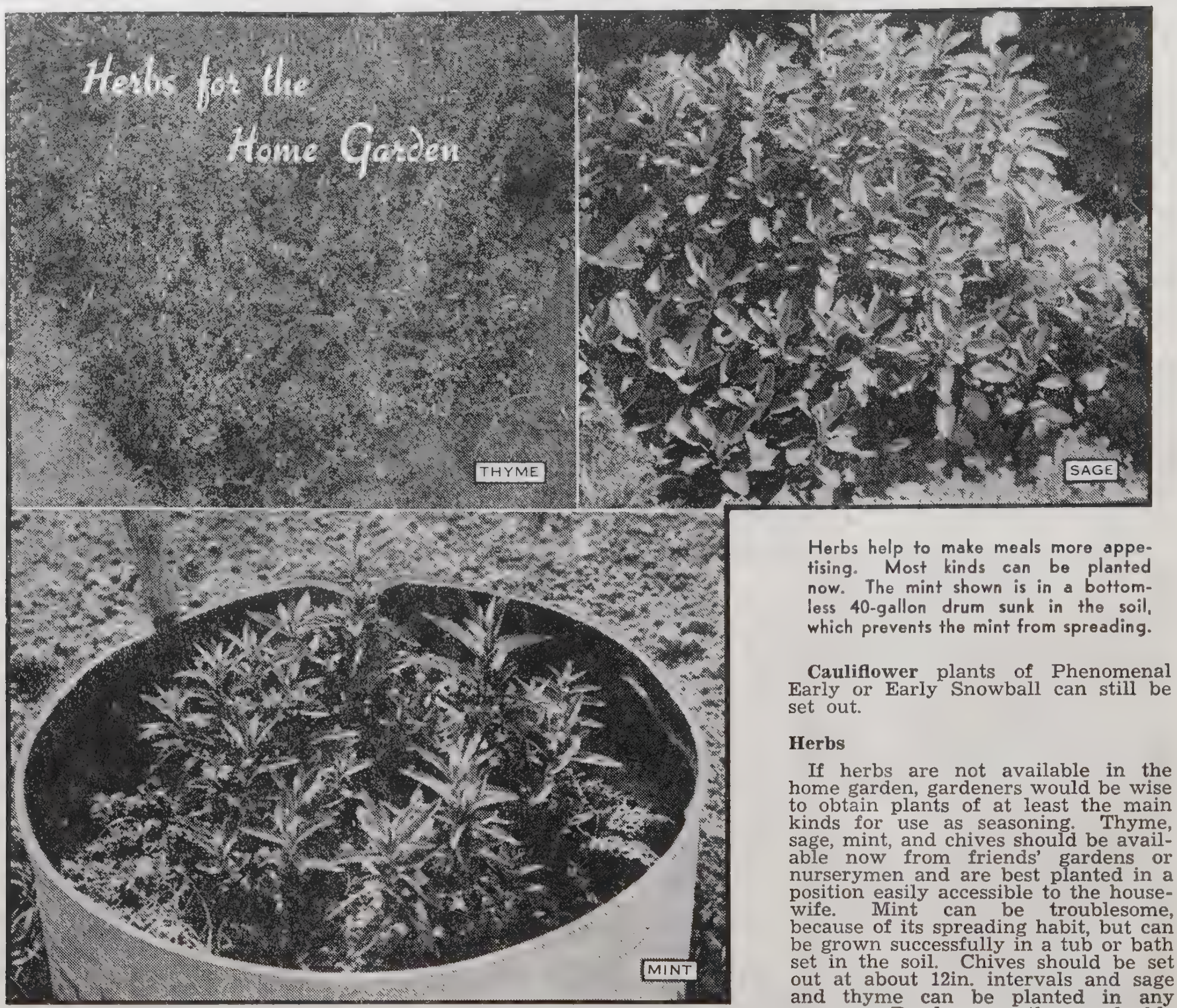
Boxes are a handy means of raising seedlings, as they can be shifted easily or covered as conditions dictate. They can also be taken to the garden plot when planting out is to be done, thus reducing the drying out of plants. Boxes tend to warm up quickly and maintain higher temperatures than soil in the open, because of the smaller volume of soil in them. However, drying out may occur because of this small volume of soil, and for that reason boxes need much more attention than beds in open ground. Watering should be done through a fine rose. Another satisfactory method is to soak the boxes in a shallow tray of water until the moisture shows evenly on the surface. This method does not dislodge small seeds, as may happen when water is applied by can.

Boxes should be prepared up to the layer of fine soil (D) shown in the diagram at left. This should be compacted evenly and gently before sowing, particular care being taken with the corners.

Seed can be pressed gently into the soil and covered with fine or very fine soil according to the type of seed. Soil should be fairly moist when seed is sown.

Successional Sowing

Often gardeners will sow large quantities of seed at a time, and



Herbs help to make meals more appetising. Most kinds can be planted now. The mint shown is in a bottomless 40-gallon drum sunk in the soil, which prevents the mint from spreading.

[*Green and Hahn Photography Ltd. photos.*

subsequently much of the crop is wasted because much more than can be consumed matures at one time. Small, successional sowings should be the aim with most crops, the periods between sowings being governed partly by the kinds of vegetable. The method tends to save seed and makes freshly matured and better vegetables available throughout the season. Successional sowing is more important with crops sown directly, such as early carrots, beetroot, spinach, lettuces, turnips, and radishes.

Garden Work for July

Opportunity should still be taken to complete all odd jobs about the garden before the busy season begins. Spray equipment, garden implements, garden paths, and the tool shed may all need attention. Most of this work can be attended to indoors on wet days.

Sowings

The following can be sown, provided precautions mentioned are taken:—

Lettuce varieties Imperial 615, Neapolitan, Winter Market, and All the Year Round in boxes, frames, or raised beds in sheltered corners.

Tomatoes, preferably tall varieties, in boxes or frames for early planting in mild districts.

Broad beans in wide drills, provided soil conditions are not too wet.

Radish and spring onions in raised beds in any sheltered corner, if conditions are satisfactory. French Breakfast and Red Turnip-rooted are good varieties of radish and any commercial variety of onion is satisfactory for spring use.

Spinach of prickly seeded varieties is best sown in raised beds.

Silver beet can be sown in mild districts or in raised seed-beds in other districts for planting out later. Lucullus and Giant Broad White Rib are good varieties.

Plantings

Cabbage plants of Enfield Market, Earliball, and Golden Acre can now be set out, preferably on ridges.

Cauliflower plants of Phenomenal Early or Early Snowball can still be set out.

Herbs

If herbs are not available in the home garden, gardeners would be wise to obtain plants of at least the main kinds for use as seasoning. Thyme, sage, mint, and chives should be available now from friends' gardens or nurserymen and are best planted in a position easily accessible to the housewife. Mint can be troublesome, because of its spreading habit, but can be grown successfully in a tub or bath set in the soil. Chives should be set out at about 12in. intervals and sage and thyme can be planted in any corner. Parsley, another valuable herb, is best sown at least twice a year, if good leaf is expected. The first sowing can be made as soon as soil conditions are satisfactory. The curled type is most popular in New Zealand.

Other Reminders

Peas can be sown in mild districts where soil conditions are not too wet or cold. William Massey and Little Marvel are good varieties. New asparagus beds should be planned now for planting in August. The soil is best trenched and a liberal quantity of organic matter should be incorporated. All perennial weeds should be eliminated before planting.

Liquid nitrogenous manure should be applied to winter leaf crops to keep them growing.

Small lots of early potatoes can be sown if conditions are satisfactory. Seed potatoes for later plantings should be laid out for sprouting. New rhubarb beds can be prepared in a similar manner to those for asparagus.

Onion seed can still be sown, preferably on raised beds.

Using Firearms Safely and Skilfully

PREVIOUS articles in this series by G. G. Kelly, Arms and Ballistics Officer to the Police Department, have dealt with firing practices, correction of faults in shooting, types of sporting rifles and ammunition, and the setting of sights. This article describes the use of shotguns, and the concluding article, to be published in next month's "Journal", will discuss the construction of shotgun barrels, grades of shot pellets, and the taking of patterns of shotguns.

THE shotgun is suitable for the destruction of rabbits, hares, stoats, weasels, polecats, wild cats, sheep-worrying dogs, and all bird pests, including geese. It is not suitable for goats, deer, wild pigs, or heavier animals, though it can be used for these at very short range and with special cartridges loaded with ball.

The range of the shotgun is limited to 55yds. for all practical purposes, but occasionally kills are made at longer distances. The weapon is intended for quickly moving marks, and this makes it ideal for shooting over dogs at rabbits in low scrub and tussock or where ferrets are being used to drive rabbits from burrows.

Wide Use of 12 Gauge

Four main gauges of shotgun are in general use- -12 (the most popular), 16, 20, and .410, which is used in orchards against birds. The most effective gauge is the 12, as it uses the heaviest charges of powder and shot. Though it is not generally realised, the pellets have the same velocity in the four gauges, but the 12-gauge cartridge has a greater number of them and therefore gives a denser pattern at extreme range than the cartridges of the smaller gauges. The weight of charge of shot in the 12 gauge is 1⅛oz., compared with 1oz. of the 16 gauge, ¾oz. of the 20, and 3/10oz. of the .410. The differences in the costs of the cartridges are not great and this may partly explain why most farmers prefer the 12 gauge. As orchardists have to consider the amount of damage that may result to trees when the heavier gauges are used, the smaller .410 gauge is normally used by them for the killing of blackbirds and opossums.

Several kinds of guns are used, the commonest being the single-barrelled hammer gun of American origin. This is popular because the initial cost is low; it serves the needs of a large number of people, especially young men buying their first gun.

Double-barrelled guns, both hammer and hammerless models, are in wide use among men who use a gun for important work, as this type allows a quick second shot where the first has been ineffective. For farm work either the hammer or hammerless gun is satisfactory, as it develops the full power and range of the cartridge. The general choice in recent times has been the hammerless, as it will stand more rough treatment and is safer in the hands of less skilled users.

Repeating and auto-loading shotguns are not as commonly used in New Zealand as single- and double-barrelled guns, but they are quite satisfactory and are as safe to use as the double-barrelled hammerless.

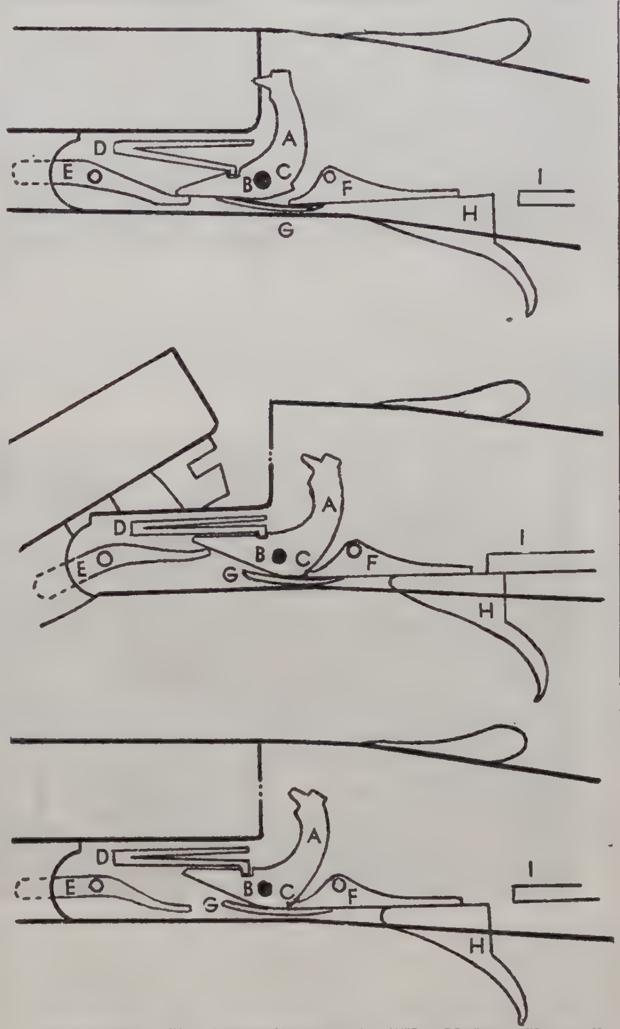
Differences between Hammer and Hammerless Guns

The hammer gun is so called because the hammers are exposed. The hammerless is equipped with hammers or tumblers which are enclosed inside the action body and cannot be seen. In the hammerless gun the component is called a tumbler, never a hammer, but is referred to as a hammer in the hammer gun. In both types of gun the part is powered with a strong spring that is compressed to its maximum when the gun is cocked. Both guns are fired by a backward pressure of the trigger or triggers; this movement unseats the sear from the bent in the hammer or tumbler, which flies sharply forward under the impulse of the main spring, striking the primer a sharp blow and causing discharge.

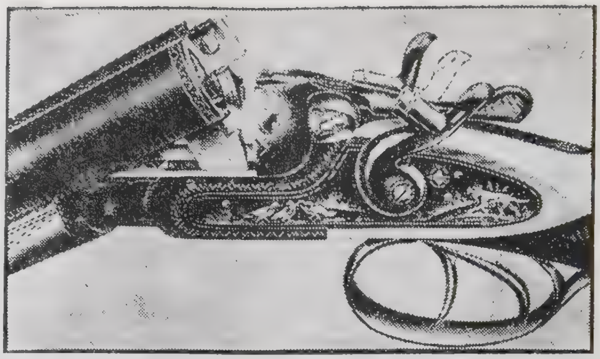
Though the firing action in both guns is similar, there is a difference in mechanical operation which is of considerable importance in the risk of accidental discharge.

The hammerless gun always cocks the tumblers when the action is opened and closed. No interference with the tumblers is possible, and unless the triggers are lighter in "pull" than they should be (4 to 4½lb.), the tumblers cannot be uncocked except by pulling the triggers and firing the gun if it is loaded. A trigger-locking safety device is automatically applied when the breech is opened. To allow the triggers to be operated this has to be pressed forward

The breech of a double-barrelled hammerless shotgun. Because hammerless guns have no projecting hammers, which can cause accidental discharge, and are usually provided with an automatic safety catch they are far safer to use than guns with exposed hammers.



[*After Major Sir Gerald Burrard in "The Modern Shotgun"*.
The principal working parts of the Anson and Deeley action. A—Tumbler. B—Tumbler peg. C—Bent. D—Main spring. E—Cocking lever or "dog". F—Sear. G—Sear spring. H—Trigger. I—Safety stop. Upper—Gun closed and fired. The trigger (H) is still pressed. Middle—Gun opened. Lower—Gun closed and ready for firing.



The breech of an exposed-hammer gun. The near hammer is in the cocked position and the far one in the uncocked position. If, with the breech closed and the gun loaded, the uncocked hammer became caught on an object, was knocked back to any position between uncocked and that shown by the dotted outline, and was then suddenly released, discharge would almost be certain.

when a shot is to be fired. In a small proportion of guns the safety catch has to be applied instead of being automatic.

The hammer gun on the other hand, because its hammer is exposed and therefore likely to be knocked, can be fired without the trigger being used. These unintended discharges can be caused in three ways: First, by a sharp blow on the back of the hammer when it is uncocked. This drives the hammer forward and discharge is usual. Second, by the hammer being partly cocked and immediately released as the result of its being caught on an object when the gun is dragged behind the user; an example of this is the catching of the hammer on a wire as the gun is being pulled through a wire fence. Third, by the hammer slipping from under the thumb in the act of cocking. If this occurs before the sear can engage and hold the hammer at full-cock, discharge is almost certain.

By uncocking a hammer gun when a cartridge is in the breech a user not only deludes himself that he has made the gun safe to handle, but exposes himself to the risk of accidental discharge which can occur when the gun is uncocked. Deaths and serious injuries are constantly being recorded through users of hammer guns being unaware of the danger of this practice. Hammer guns must never be uncocked while there is a cartridge in the breech.

In the evolution of the shotgun the hammer gun followed the early muzzle-loading guns of various kinds.

The hammer gun has been superseded by hammerless types, including the hammerless with what are known as "under-and-over" barrels. This arrangement consists of having one barrel above the other instead of having the two side by side as is usual.

The hammerless gun was invented by English gunsmiths. The most popular design is known as the Anson and Deeley pattern, which has been copied, with only slight modifications, all over the world. This type of gun rapidly became popular and displaced the earlier kinds, with their ugly, projecting hammers, in the esteem of sportsmen. The hammer gun still survives and is mostly confined to the cheaper markets.

After the novice shooter has thoroughly learnt the differences between hammer and hammerless guns and the causes of accidental discharges he should be taught that in the shooting field the gun is useless unless it is loaded and cocked. There is not a second to lose when game is flushed or started.

As safety lies with the user rather than with his gun, he should be determined to carry the gun firmly in both hands. If one hand has to be removed from its grip for any reason, even for an instant, the gun should be unloaded or at least the breech opened.

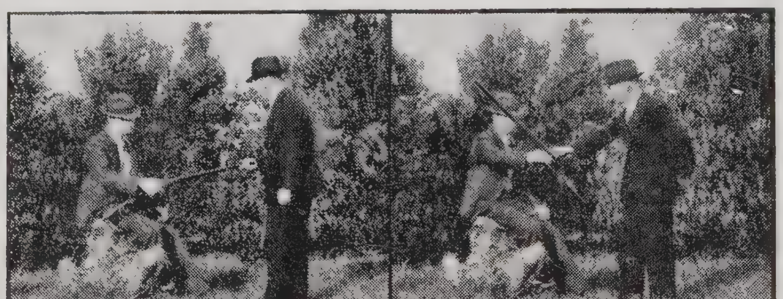
Importance of Judging Distances

One of the most important principles governing the successful operation of the shotgun is the shooter's ability to judge distance and especially to determine at a glance whether the mark is within range or not. It therefore pays well to be able to judge within a yard or so a range of 50yds., and ability to do this will come from patient practice which can be carried out in a walk across a field as described in last month's article. The eye is fixed on a mark, an estimate of the distance is made, and the estimate is checked by stepping out the distance. By this practice a considerable degree of accuracy can be acquired in a few days.

Next in importance is ability to judge the speed of the mark and thus be able to make due allowance in aiming ahead or "leading". Until proficiency in judging distance and aiming ahead is reached much ammunition can be used uselessly. Perhaps the easiest marks on which to practise the "running" shot are hares and rabbits. As hares are larger and start off their run more smoothly than rabbits, they are easier to hit; on the other hand rabbits provide a number of angle shots that are often unpredictable, and as they appear unexpectedly, shooting at them is excellent practice for the pupil.

Ground game should be the first field of practice for the novice with a shotgun. As animals have a fairly constant horizontal plane of flight, they are easier to hit than birds, which can move quickly in all directions. However, good training can be done under competent instruction with the use of clay birds, as has been shown by R.N.Z.A.F. trainees. Where clay bird "traps" are not available it is possible to have useful practice at empty fruit tins tossed in the air by the instructor.

Experience in a gun club is valuable for more than the development of skill in shooting. The strict rules for the safe handling of guns give young men a good grounding in the art of shooting. Like rifle clubs, gun clubs have almost an unblemished record in the safe conduct of shooting.



MANY accidents with firearms occur because of carelessness in handing the weapons from one person to another. Every precaution should be taken to ensure that there is no danger of the firearm discharging. Even if this should happen, however, it can be held in such a way that the risk of its injuring anyone is eliminated.

In the illustration at left both men are at fault and the man receiving the gun is in danger. When the gun is passed in the manner shown in the right-hand illustration this danger is avoided. The gun should be held at the point of balance with the muzzle pointed upward; as an additional safety measure both hands should be used in passing and receiving a gun.

Never allow the muzzle of a firearm to point at anyone, and take special care when handing a weapon to someone else. *—G. G. KELLY*

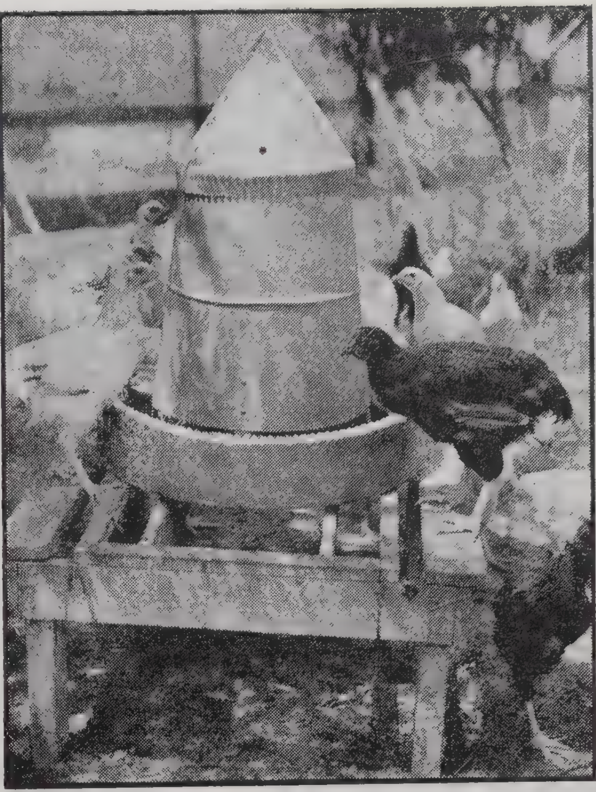
Feeding of Laying Birds in a Household Poultry Flock

TYPES of food required for young growing birds and laying pullets in the household poultry flock were described in last month's "Journal". This article by the Animal Industry Division details methods of feeding and quantities of food required. To feed poultry well is not difficult, but a knowledge of what and how to feed is essential for best results. That is particularly so during winter, when obtaining satisfactory egg production is more difficult than in spring and summer, or the flush period, when heavy laying is natural.

SEVERAL systems have been evolved for feeding laying birds, either pullets or hens, all of which will give satisfactory results if carried out correctly. Two of these are common throughout New Zealand, and which is selected may be left to the householder's choice. Each has its advantages and disadvantages.

Systems Compared

Wet mash and grain: Two meals may consist of hard grains and one of standard mash No. 1 mixed with water to a moist, crumbly texture. The meals may be arranged in either of two ways to suit circumstances: If the mash is fed in the early morning, a small grain feed is given at noon; if a small grain feed is given in the early morning, the mash follows at 10 a.m.; in either case a full grain feed is given in the late afternoon. The small grain feed should consist of a third of the daily ration and the afternoon feed of the remainder. Wet mash can be omitted on Sundays without harm being done provided the total grain feed for the day is about doubled; only two meals are then necessary, in the morning and late afternoon. This method is used for all the birds on the Department's Poultry Demonstration Plant, Upper Hutt, except those which normally receive dry mash.



[*Fraser Niederer photo.*

A well-made automatic dry-mash hopper, with a lip on the saucer to prevent wastage of the feed and a "dunce's cap" to prevent birds from perching on top.

Dry mash and grain: Grain may be fed twice daily, morning and afternoon, and dry mash kept before the birds in a properly constructed hopper throughout the day. The mash may be the same as that used with the wet-mash system. A dry-mash hopper must be kept well filled and the mash flowing or falling down freely into the feeding area or the birds may be underfed.

Wet-mash feeding, which is used by many poultry farmers, has two advantages for the household poultry keeper: Household food scraps can be mixed into the mash, and no food is left in the fowlhouse overnight to attract rats. Dry-mash feeding, on the other hand, requires less labour and time and the birds can be left for longer periods without taking harm. However, it calls for an efficient type of hopper into which birds cannot get and which prevents mash being wasted by birds scooping or pecking it out on to the floor. Hoppers suitable for this purpose are illustrated on the next page. Wet mash is fed in an open, V-shaped trough of simple construction.

Quantities of Food

Quite often owners of poultry are apprehensive lest they overfeed their birds. This attitude is based on a common fallacy. Laying birds largely regulate their appetites to their requirements as determined by their rate of egg production. A bird in a moult and out of production eats comparatively little—certainly well under 4oz. of food a day—but a high-producing bird in full lay may well eat 5oz. in a day. A heavy-breed bird, with a larger body to maintain as well as laying eggs, needs more food than a light-breed bird.

However, it is true that poor-producing birds will put on fat despite the fact that they are unlikely to be heavy eaters. Furthermore, if they are fed a badly unbalanced mash, containing an excessive amount of starchy or fattening foods and insufficient protein or egg-stimulating foods, even good producers may become fat.

Reminders for July

July is the month in which to decide what pullets are required for next year. Place an order with a reliable breeder for birds to be delivered at the end of this year or early next year. The hatching and rearing season has begun.

If chickens are to be reared, remember that the inclusion of a fish oil in the feed is essential to supply the young birds with vitamins D and A.

Egg production should be increasing in July, and any hen or pullet not in lay should be culled as an uneconomic producer. Egg prices will fall in August with the advent of the flush season.

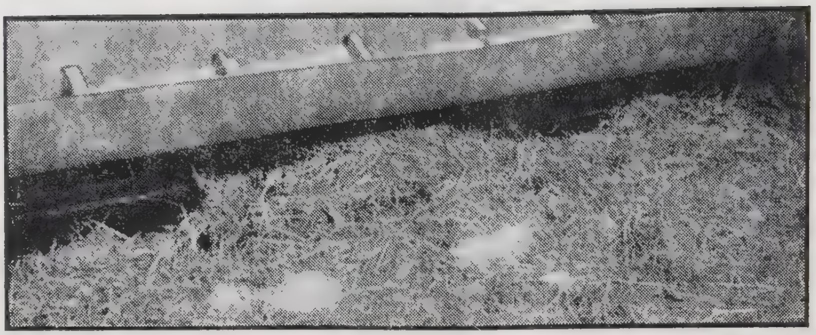
A bird in lay may be expected to eat about 4oz. of food daily. When fed wet mash and grain the birds should receive about the same amount of each, the mash being weighed dry. However, the quantity of food given must be adjusted to the rate of egg production. This can be done by feeding grain at about 2oz. per bird daily without appreciable variation and increasing or decreasing the amount of wet mash according to what the birds will eat regularly in 20 to 30 minutes; if mash is left over after this time, the next mash feed is reduced, but should the birds eat the mash up readily in 10 to 15 minutes and be prepared to eat more, the next meal is increased. This method ensures that the requirements of the birds are met, and this is an important factor in good and consistent egg production.

For dry-mash feeding the grain ration should be maintained at about 2oz. per bird daily, the birds regulating their own requirements of mash from the hopper.

Mixing Wet Mash

If the best results are to be obtained from the use of wet mash, it should be correctly mixed—a task requiring some care and skill. Good wet mash should be an appetising, crumbly mixture, not too dry and certainly not sticky or tacky. A simple test is to take a handful of the wet mash and firm it up into a ball which, if dropped from a foot above the ground, should break up on hitting the surface.

Whether wet mash is easy or difficult to mix depends on the consistency



Food spilt into the litter like this not only is food wasted but it attracts rats, mice, and small birds.

of the dry ingredients. A mash containing bran or other bulky foods is often more easily mixed with water than a fine mash containing much floury material, which tends to become sticky immediately water is added. The addition of household scraps invariably makes more difficult the mixing of good wet mash, which is one reason why big quantities of scraps should not be added. Furthermore, the addition of much bread or potatoes, which are rich in starch, tends to unbalance the mash and give it fattening properties. Both sticky mash and insufficiently moistened mash soon become unpalatable to birds, and sticky mash is likely to clog the birds' beaks and set up trouble.

Grain

The grain ration may be fed in a V-shaped trough or scattered in the litter, in which case a watch should be kept to ensure that grain is not being wasted as a result of feeding more than the birds require.

It is not recommended that grain be fed on the ground in an outside run, as it attracts sparrows and rats.

Greenfeed

The first essential with greenfeed is that it be young and succulent, not old and fibrous. Greenfeed may be hung up in the fowlhouse for the birds to peck at or be chopped up and trough fed. Throwing it on the floor of the house is not advisable, as what is not eaten rots, smells, and tends to make the litter unpleasant. Greenfeed may be chopped up and included in wet mash, thus ensuring that all birds receive a proportion of it.

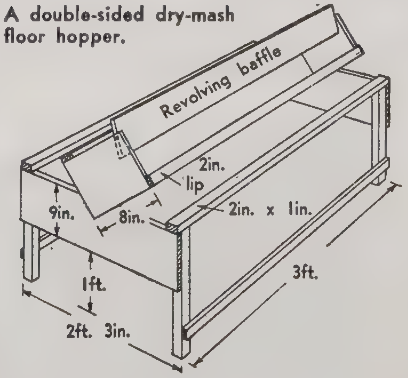
Greenfeed is fed mainly for its valuable vitamin A content.

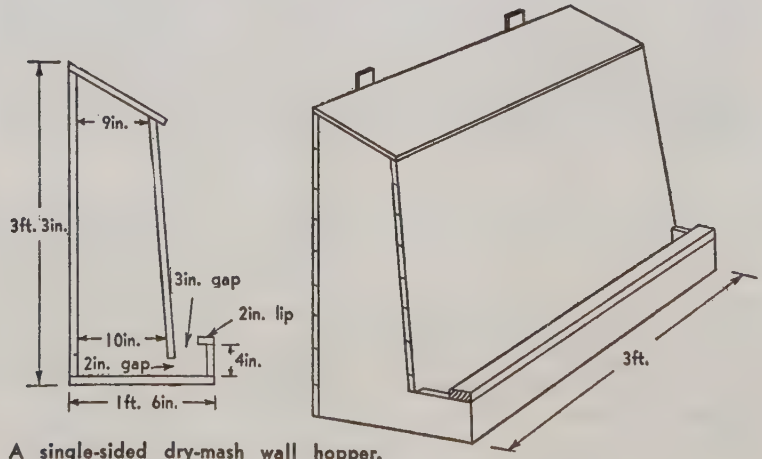
Fish Oil

As vitamin A is essential for satisfactory egg production, trouble may well arise when greenfeed is scarce or is of poor quality, as it may be during winter or dry weather. At such times it is desirable to feed a fish oil in the mash or on the grain. Fish oils rich in vitamin A are readily procurable. The quantity to use is 3 tablespoonfuls to each 10lb. of mash or grain if the oil contains 2000 international units of vitamin A per gramme. The vitamin content should be stated on the tin or invoice; if not, inquiry should be made. An oil containing only 1000 units of vitamin A per gramme should be used in double the quantity.

If oil is incorporated in the mash, it should be mixed in thoroughly with the hands, preferably first into a small amount of mash which is then mixed into the bulk. Fish oil mixes easily with grain, leaving a film on each grain. Oiled grain should be fed in a trough and not scattered on the litter to collect dirt on the oily surfaces.

A double-sided dry-mash floor hopper.





A single-sided dry-mash wall hopper.

Grit

Both shell grit and metal grit should be placed in boxes which are open to the birds at all times, preferably on a wall of the fowlhouse and high enough to stop the birds depositing litter in the boxes when they are scratching for grain.

Water

An adequate supply of water at all times is as essential as food. Containers that can be washed out easily are desirable. Dirty drinking troughs, stale water, and water warmed by the sun in hot weather are factors in poor management and may be detrimental to the birds.

Where winters are cold and frosts heavy it is beneficial to the birds to refill the water troughs early in the day with water which has had the chill taken off it.

Winter Egg Production

The most valuable egg of the year, and in some ways the most difficult to get in quantity, is that laid in winter. To lay in winter is unnatural for a bird, and only by domestication and careful breeding have poultry been induced to do so.

Therefore special care should be taken during winter. Colds, damp litter, draughty houses, sudden changes in diet, and careless management may all lead to neck moulting and birds going out of production and they are then difficult to bring into lay again until well into winter or as spring approaches. Once they are in lay in autumn or early winter the birds must not receive a check or lose body weight. In addition to careful feeding of grain and laying mash containing meat meal it is recommended that a box filled with meat meal be kept before the birds during late autumn and winter. The birds will not eat too much of this meal after it has been in the house for a few days, and it will help to stimulate laying; it is not needed to the same extent in the flush spring and summer periods.

Where winter conditions are normally changeable and unpleasant, heavy-breed birds such as Australorps are less affected by the weather than are light breeds.

Too many household poultry keepers fail to get reasonable winter egg production because they have very late-hatched pullets, poor-quality birds, poor housing conditions, or insufficient knowledge of correct feeding methods.

Recent Research Work

PASTURE PROBLEMS

A MAJOR PART of the field experimental work of the Department of Agriculture's Extension Division is devoted to investigation of local problems of pasture establishment and management. Some recent work of this nature is described on this page.

LUCERNE: WAITAKI COUNTY

A FARM SURVEY was carried out in 1950 on the area of light land of about 30,000 acres that lies on the south bank of the Waitaki River in North Otago. This study of farm management and financial data further establishes the value of lucerne on these stony terrace soils. Lucerne provides strategic reserves of nutritious hay for feeding out in periods of shortage and in addition provides greenfeed for grazing off in a drought. On the poorest soils and on farms below the average size of 700 acres lucerne has been used to increase both sheep numbers and profits.

The leading lucerne grower is getting excellent results on land of the lowest unimproved value per acre. At the time of the survey he had 13 per cent. of his farm in this crop. He is increasing this acreage as he brings more of his poor pastures under cultivation. Lucerne, which he grazes rotationally, is replacing pastures to a marked extent. On land of an unimproved value of only £1 12s. per acre he earned an interest surplus of £2 2s. per acre for that year—the second highest surplus in the survey. Interest surplus is arrived at after allowing for all farm expenses and a reasonable management reward to the farmer, but does not include interest on mortgages on land. The average for the 11 farms was land of £3 4s. unimproved value per acre earning an interest surplus of £1 4s. per acre.

Costs of sowing down lucerne are about the same as for pasture. However, as lucerne outlives the productive life of ryegrass pastures, which tend to run out in a few years, the saving in cultivation costs for resowing is considerable. On the highest terrace the hard pan may present some difficulty for lucerne, but nevertheless lucerne should be tried more as a pasture than as a special crop. A large area of lucerne pasture is a way to farm improvement on this light land.

—*A. H. MOUAT*

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SHORT-ROTATION RYEGRASS: TARANAKI

CENTRAL TARANAKI with its high rainfall and absence of summer drought provides an ideal climate for short-rotation ryegrass. This strain of ryegrass, when autumn sown, adequately fertilised, and properly grazed, will provide the dairy farmer with a high-producing pasture. Of particular benefit is the high production during winter.

The success of this grass depends largely on the establishment and maintenance of the clovers sown with it. It is necessary to plough early and work the ground thoroughly from the bottom up so as to finish with a firm, fine seed-bed. Short-rotation ryegrass grows best under high-fertility conditions, and applications of phosphates and, where necessary, potash should be liberal. On most of the dairy-farming country in central Taranaki 3cwt. of phosphate and 1cwt. of muriate of potash per acre is the minimum dressing at time of sowing. The same dressing should be applied 6 months later and thereafter annually.

For the first 6 months the grass should be kept grazed below 4in., thus allowing light to reach the clovers. For the same reason this grass should not be cut for silage in its first year. Once clover establishment is ensured the grass must be rotationally grazed. This means rationing of the grass and grazing it from a height of 6 to 9in. down to 3 to 4in. Quick, even grazing punishes the grass less and gives a more even spread of dung and urine, and is not confined to overgrazed, weedy patches surrounded by areas of rank, unpalatable grass. Short-rotation ryegrass at 9in. is still a palatable and nutritious feed.

All farmers in central Taranaki who have sown short-rotation ryegrass and managed it well have been very satisfied with its performance. On many farms it has lasted for only about 2 years because of excessively hard grazing.

—*J. M. LOCKHART*

* * * *

PHOSPHATES ON NEW PASTURES

EXPERIMENTAL EVIDENCE accumulated during the past 20 years has shown that heavy phosphating is necessary for pasture establishment on ploughable scrublands in North Auckland and South Auckland Land Districts, and that has now become generally adopted in farm practice. A trial carried out recently in the Matamata district on Hunga-Hunga peaty loam indicates that the benefits conferred by heavy phosphating may not be confined to the development of virgin land and that a further application of phosphates 2 or 3 months after sowing may be well worth while on a wide range of soil types.

A field previously in poor pasture was sown to new grass in March 1951 with 2cwt. of serpentine superphosphate per acre. A good strike was obtained and the first growth fed off. In May a replicated trial was laid down using lime, superphosphate, and potash in different combinations, and 7 weeks later the plots were mown and the green herbage weighed. All treatments gave an increased yield, but the addition of 3cwt. of superphosphate increased the yield by 50 per cent.

—*G. A. BLAKE*

* * * *

GRASSING OF SURFACE SLIPS

HEAVY RAINS caused extensive surface slipping throughout the Poverty Bay-east coast district in May 1948. In the hope of re-establishing grass and preventing deeper erosion four representative slips were sown within a week of cessation of rain and four more in June and July 1948 when it appeared that some soil movement had ceased. All slips were sown with 24lb. per acre of the following mixture: Perennial ryegrass 1 bushel, browntop 2lb., Italian ryegrass ½ bushel, Chewings fescue 4lb., subterranean clover 4lb., white clover 2lb., crested dogstail 4lb., and yarrow 2lb. Both sunny and shady faces were sown in the Whatatutu and Patutahi areas, the soil types being Kidnappers sandy loam and Mangawhare sand loam (hill phase).

Where the soils were reasonably fertile and the slips were on shady faces white clover was established successfully when sown immediately all soil movement had ceased and while the soil was still sticky on the surface. On sunny faces sowing immediately after slipping gave poor results.

—*H. deO. CHAMBERLAIN*

* * * *

POTASH FOR PUMICE SOILS

FOR SOME YEARS it has been realised that in many parts of the pumice country of the Rotorua district all was not well with the pastures, despite adequate topdressing with phosphatic fertilisers and otherwise-good management. During the 15 years before the outbreak of the Second World War a very considerable number of comprehensive topdressing trials were laid down on various soil types. Without exception they showed good responses to phosphates such as superphosphate, basic superphosphate, and basic slag, but very few responded to potash treatment, and on these the responses could only be described as slight. Unfortunately the war prevented a continuation of these valuable experiments and so denied to observers the opportunity of forestalling a situation which has created something of a problem for many farmers—serious pasture deterioration caused by acute potash deficiency.

Two years ago an attempt to solve the problem by a newly developed soil-testing technique was undertaken on a limited scale in one district. Results of this investigation indicated fairly clearly the source of the trouble: All the major plant nutrients were in satisfactory supply except potash, and this was practically non-existent. Several potash-topdressing trials were then laid down on affected pastures, the rates used being 2, 1, and ½cwt. of muriate of potash per acre initially, followed by ½cwt. in succeeding years. Responses to these treatments were both rapid and substantial, leaving no doubt that in the adequate use of potash fertilisers lies the solution to the difficulties experienced. This work has since been extended to other districts with similar results, lucerne as well as pastures obviously benefiting from the treatment.

The present recommendation for the use of potash is 1cwt. per acre initially, applied in early September, followed each spring for some years by ½cwt.

—*C. R. TAYLOR*

A Knitted Vest and Pants Set for a Baby

THE baby's knitted vest and pants illustrated are in white with trimmings of pink. If the tension is 7 stitches to the inch over lace pattern on No. 10 needles and 7½ stitches to the inch over lace pattern on No. 12 needles, the instructions in this article are for garments of the following dimensions:—Vest: Length, 10½in.; chest, 17in. (unstretched). Pants: Length from waist to crutch, about 7½in.; measurement all round at widest part, about 20in.

MATERIALS needed are: 3oz. of 3-ply white baby wool, a small ball of pink 3-ply baby wool, two No. 10 and two No. 12 knitting needles, four buttons, and ½yd. of elastic for the pants.

Abbreviations used are: K., knit; p., purl; st., stitch; st. st., stocking stitch; g. st., garter stitch; patt., pattern; rep., repeat; cont. continue; beg., beginning; inc., increase; dec., decrease; tog., together; sl., slip; p.s.s.o., pass slipped stitch over; m. 1, make one; d.c., double crochet; s.c., single crochet; ch., chain.

Vest Front

With No. 10 needles and white wool begin at left shoulder edge and cast on 15 st. Work 4 rows in g. st.

Shaping for Neck

First row: K. twice in first st., k. to end. Second row: K. to last st., k. twice in last st. Rep. these two rows three times more (23 st.).

Break off wool and work a second piece in the same way for right shoulder. Break off wool and slip the 23 st. of right shoulder on to other needle.

Rejoin wool and, starting at straight edge of right shoulder, k. to end. Then cast on 8 st. Starting at shaped edge of left shoulder k. to end (54 st.).

Change to pink wool. Next row: K. to end. Next row: K. 1, * m. 1, k. 2 tog. Rep. from * to last st., k. 1.

Break off pink wool and k. 1 row in white wool. Cont. in rib thus:—First row: K. 2, * p. 2, k. 2. Rep. from * to end. Second row: P. 2, * k. 2, p. 2. Rep. from * to end. Rep. these two rows until work measures 2¾in. from cast-on edge of shoulders.

Shaping the Armholes

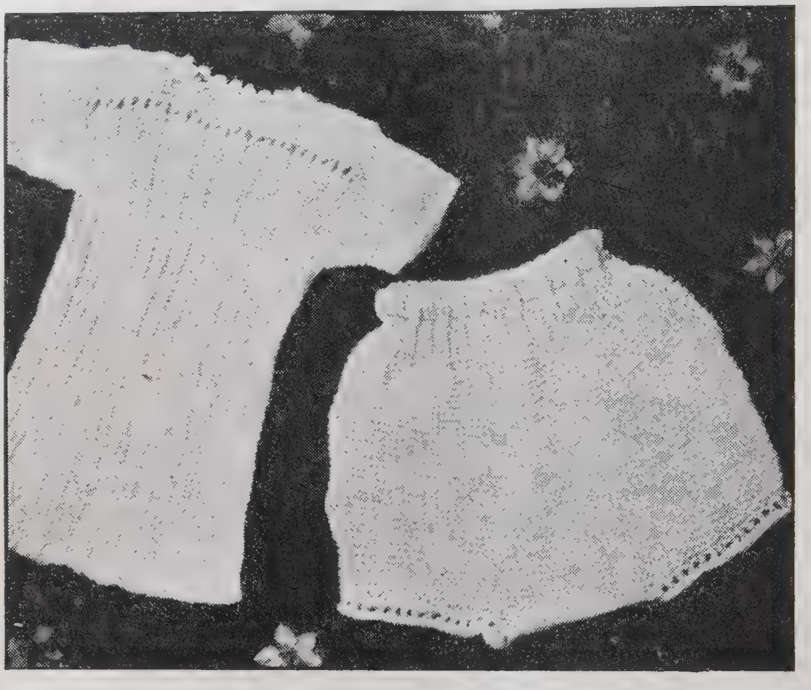
Inc. 1 st. each end of every row until there are 62 st. Cont. straight in rib until work measures 10½in. from cast-on shoulder edges. Cast off fairly loosely in rib.

Vest Back

With No. 10 needles and white wool cast on 15 st. and work two rows in g. st. Next row: K. twice in first st., k. to end. Next row: K. to last st., k. twice in last st. Rep. these two rows (19 st.).

Break off wool and work a second piece in the same way.

Break off wool of second piece, slip stitches back on to other needle, and rejoin wool. Starting at straight edge, k. to end, cast on 16 st. Starting at shaped edge of first piece, k. to end (54 st.). Work 6 rows g. st. across all stitches.



Change to pink wool. Next row: K. to end. Next row: K. 2, * m. 1, k. 2 tog. Rep. from * to end.

Break off pink wool and cont. in rib with white wool as given for front, shaping armholes and working length to match.

Vest Sleeves

Join shoulder seams for about ½in. at armhole edges.

With right side of work facing and using No. 10 needles and white wool pick up and k. 64 st. evenly along armhole edges (32 each side of shoulder seam). Work in k. 2 p. 2 rib as given for front; dec. 1 st. each end of alternate rows until 54 st. remain.

Change to No. 12 needles and work ½in. in rib. Cast off fairly loosely in rib.

Work the second sleeve in the same way.

Pants

With No. 12 needles and white wool cast on 64 st. and work ½in. in k. 2 p. 2 rib. Next row: * Rib 2, m. 1, work 2 tog. Rep. from * to end. Cont. in rib for a further inch. Next row: K. 8, k. twice in next st., * k. 11, k. twice in next st. Rep. from * to last 7 st., k. 7 (69 st.).

Change to No. 10 needles and cont. in g. st. until work measures 6in.

Shaping the Legs

Cast off 6 st. at beg. of next 8 rows, then cont. in g. st. on remaining centre 21 st. for 1in.

Cast on 6 st. at beg. of next 8 rows, then cont. in g. st. until work measures 4½in. from last group of 6 cast-on stitches.

Shaping the Back

First row: K. to last 7 st., turn. Second row: K. to last 7 st., turn. Third row: K. to last 14 st., turn. Fourth row: K. to last 14 st., turn. Fifth row: K. to last 21 st., turn. Sixth row: K. to last 21 st., turn. Seventh row: K. to last 28 st., turn. Eighth row: K. to last 28 st., turn. Next row: K. to end.

Change to No. 12 needles and cont. thus:—Next row: K. 8, k. 2 tog., * k. 11, k. 2 tog. Rep. from * to last 7 st., k. 7.

Work 1in. in k. 2 p. 2 rib, make a row of holes as in front ribbing, then work a further ½in. in rib. Cast off fairly loosely in rib.

Leg Borders

With right side of work facing and using No. 12 needles and pink wool pick up and k. 64 st. evenly all round leg edge. Next row: K. 1, * m. 1, k. 2 tog. Rep. from * to last st., k. 1.

Change to white wool and work 2 rows g. st. Cast off.

Work the second leg border in the same way.

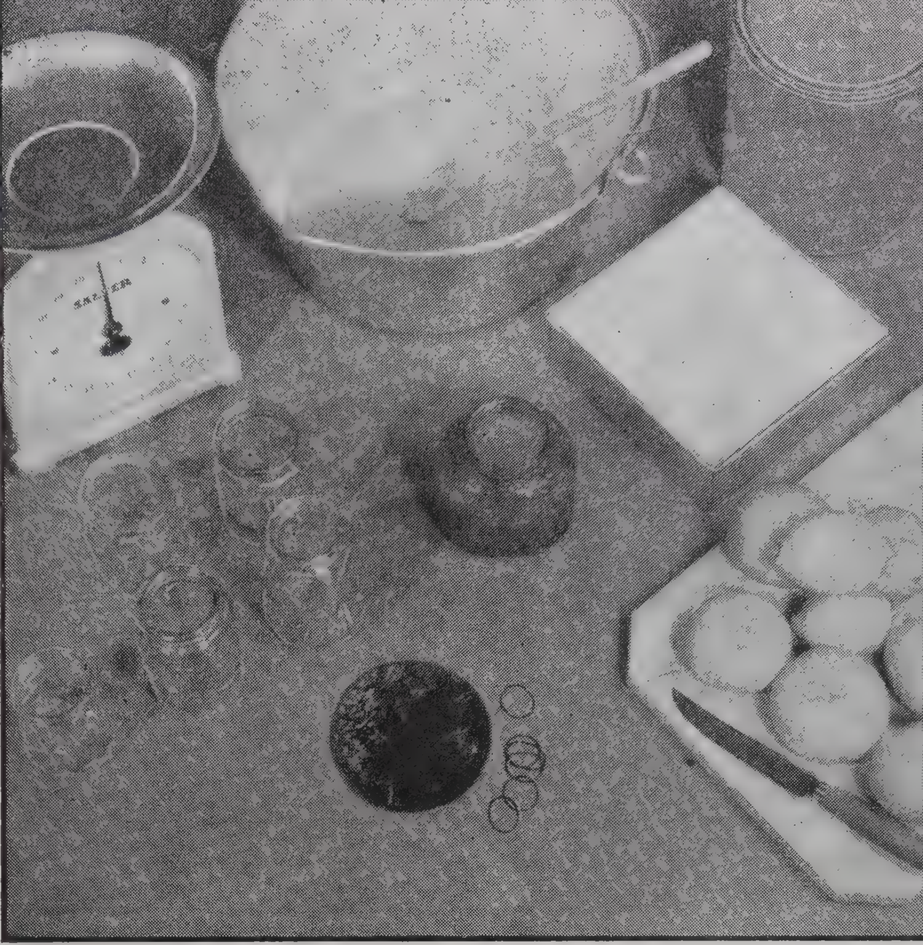
Making Up

Vest: Join side and sleeve seams. Work a row of d.c. along open shoulder edge across shoulders and neck, making 2 small chain button loops on each front shoulder. Work picot edge round neck only thus: 1 s.c. into edge, * 3 ch., 1 d.c. into the first ch., miss a small space, 1 s.c. into edge. Rep. from * to end.

Pants: Join side seams. Thread elastic through holes at waist. Press all seams and sew on buttons to correspond with buttonholes.

MARMALADE

By MAUD B. STRAIN, Field Officer in Rural Sociology, Department of Agriculture, Dunedin



MARMALADE is practically universal in its appeal and is regarded as an almost indispensable adjunct to the breakfast table, at which the provision of toast and marmalade is traditional. The making of marmalade is one of the simplest methods of fruit preservation and one of the least wasteful, because of the entire fruit nothing but the pips is discarded.

MARMALADE is another way in which fruit in season can be made available for use when it is unobtainable fresh. The general rules of food preservation apply. They aim:—

1. To stop the action of enzymes which are responsible for the normal ripening of fruit. When ripening is completed this continued action will cause decay if it is not halted. Extreme heat will check this growth.

2. To destroy bacteria, yeasts, and moulds, which are present always in air, water, and soil. Extreme heat will destroy their growth. The presence of sugar in high concentration and also of acid prevents the development of bacteria. The preserves must be covered to prevent entrance of yeasts and moulds from the air.

The name marmalade is generally applied to a preserve made from various fruits, especially citrus, and those which have an acid taste, such as oranges and lemons. It usually, though not invariably, refers to that type of preserve which depends on one or more of the citrus fruits for its acid.

Comparison with Other Preserves

Marmalade very closely resembles jams and jellies in that it requires the same three essentials: Pectin, acid, and sugar. Pectin is the gum-like substance found in varying amounts in most fruits and on which the setting or jell depends. Acid is present also in varying degrees in all fruits. Sugar has to be added.

Jams are made from crushed whole fruit, strawberries, raspberries, apricots, plums, etc., cooked with sugar to a soft jelly-like consistency and containing almost no free liquid. Jellies are made from fruit by extracting the juice by heating gently and crushing the fruit as with blackberries, red currants, etc., or by boiling it in a small quantity of water in the preserving pan until it becomes soft, and then emptying the contents of the pan into a jelly bag and allowing the juice to drip through. The juice is then boiled up with sugar, and no fruit appears in the resultant jelly. Marmalade is in some ways a jam and a jelly, because it has both fruit and jelly in the finished article. Since the fruit is never crushed, marmalade is more transparent than jam. It comprises thin slices, or pieces, of fruit in clear jelly. In successful marmalade making, as in jam and jelly making, the aim is to have a good, clear, tender yet firm jell with the least possible destruction of the natural fresh flavour of the fruit. This consistency depends on the three essentials pectin, acid, and sugar being present in the proper proportions.

The Pectin Content

The amount of pectin and acid in fruit varies from season to season. If the fruit matures and is gathered in clear bright weather, it contains more pectin and less moisture per a given weight than fruit which ripens and is harvested in a wet season. The extent to which pectin is extracted depends on the amount of acid in the fruit and also on the disintegration of the fruit, because the pectin is in the cell walls of the white inner skin as well as in the juice. Therefore the fruit must be sliced, shredded, or minced in water to allow the acid to come in contact with the pectin, since the pectin will not dissolve without the action of acid.

A simple test may be made for pectin after the first boiling, though this is not usually necessary with citrus fruits unless the fruit is very ripe and the marmalade is being made with grapefruit only. A teaspoon of the boiled liquid is put in a small glass and a teaspoon of methylated spirit added. If a clot forms, the jelly will set; if no clot forms, lemon juice must be added.

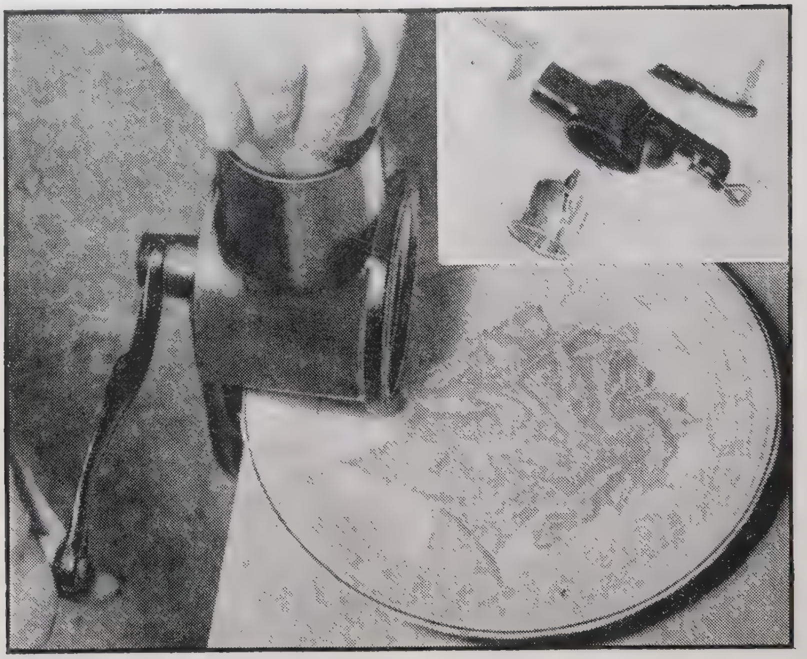
Procedure

To make marmalade, oranges about equal in size, of good colour, and free from blemishes and with a thick, soft peel are cut up and soaked in water for several hours, overnight preferably, and then boiled for about an hour until the skins are tender. This boiling should be done slowly to break down the cell walls of the white inner skin and release the pectin; rapid boiling at this stage weakens the pectin. At this point a pectin test may be done.

After the first boiling sugar in the correct amount to form a "jell" is added. With citrus fruit a much larger proportion of water is used than with any other fruit, except black currants, which are in a class by themselves. Usually in jam making the proportion is ¾lb. to 1lb. of sugar to each 1lb. of fruit with very little or no water added. In marmalade the proportions are 3 pints of water and 3lb. of sugar to each 1lb. of fruit. It is not necessary for the sugar to be warmed before it is added, though if it is warmed it cuts down the time taken to bring it to the boil again, but it is necessary to stir well, preferably with a wooden spoon, to avoid any risk of burning until the sugar has dissolved. This boiling must be done rapidly to retain the best flavour and colour. A little practice will soon enable the end point to be judged, as when the steam given off from the boiling mixture becomes scanty and the mixture offers more resistance to the stirring spoon, it is safe to assume that sufficient evaporation has taken place and that the real cooking process, which is very rapid, has begun.

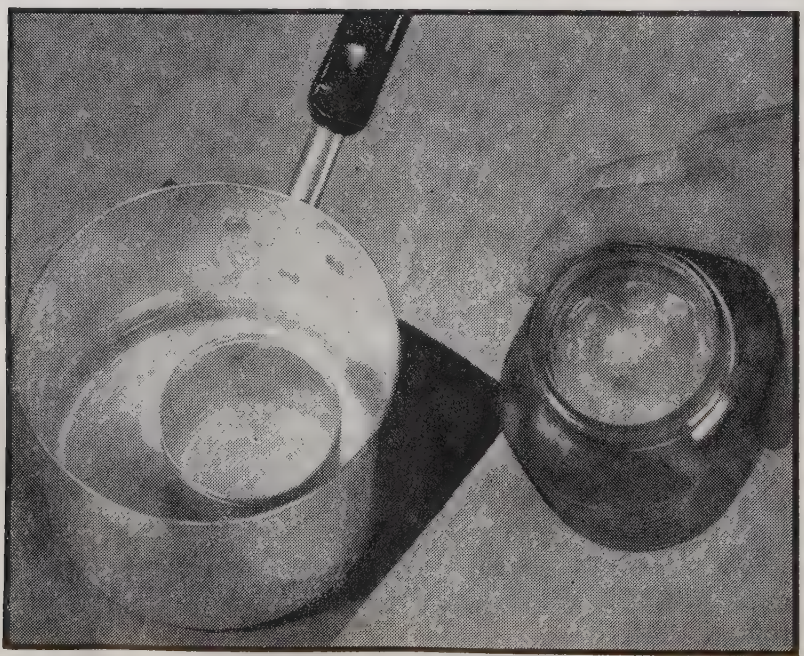
Test for Setting

At this stage it is necessary frequently to lift the spoon from the pan. The liquid falls off rapidly at first, but soon begins to run to the low edge of the spoon and drops off in a wide drop at lengthy intervals. This is the end of the cooking process and the pan should be removed rapidly from the heat. Another way of testing is to put a spoonful of the boiling marmalade in a



Marmalade orange slicer. Peel is held down by the wooden plunger while the handle is turned.

saucer, cool it, and see if it wrinkles on drawing a finger through it. The trouble with this method is that the marmalade may overcook while the sample is cooling sufficiently to test. Once the sugar has been added the jellying point may be reached after 20 minutes boiling or may take up to an hour, depending on how much evaporation took place during the preliminary boiling. During boiling a froth collects on top. This can be disregarded till the last stage of boiling, when it is necessary to remove the more solid scum. Before bottling, the marmalade should be allowed to cool somewhat and be stirred occasionally to keep the fruit evenly distributed through the jelly. If the scum is not removed, it will be incorporated in the jelly, giving an unsightly appearance.



Paraffin melted in container standing in hot water is poured on top of marmalade.

Bottling

Pour into clean, warmed bottles, being careful to stand the bottles on a dry wooden table or on several thicknesses of paper and out of a direct draught. Cover with transparent cellulose tops or, if preferred, with paraffin wax. Melt the wax and pour a layer ⅛in. thick on top of the marmalade. When the wax is set pour on another layer, turning the jar to let the wax come up the sides of the jar, cover with heavy paper, and store in a cool, dark, dry place.

Practical Hints

Oranges may be warmed slightly in the oven before they are used. This helps to make the juice more readily available. Cut the fruit in halves, squeeze out the juice, cut up the skins either with a slicer made for the purpose or, more simply, by putting the skins through a mincer. This is the quicker method, though the slicer saves considerable time over the hand cutting method. Marmalade may be substituted for candied orange and lemon peel, as well as for bottled flavourings or grated peel, in fruit cakes, small cakes, puddings, etc.

Grapefruit Marmalade

7 grapefruit
2 lemons
10 pints of water
10lb. of sugar

Slice fruit, add water, and leave to stand for some hours if possible. Bring to boiling point and boil for 1 hour. Add sugar and boil till a bit tried on a saucer sets, which takes 20 minutes to 1 hour.

Orange Marmalade

6 oranges
3 cups of water to each cup of sliced fruit
1 cup of sugar to each cup of fruit and liquid

The method is the same as that for grapefruit marmalade.

Green Gooseberry Marmalade

6lb. of gooseberries
11lb. of sugar
5 pints of water
4 lemons

Boil gooseberries, lemons, and water for 1 hour. Add sugar and boil for 3 minutes.

Apricot Marmalade

1lb. of dried apricots
1 cup of pineapple juice
4lb. of sugar
1 cup of pineapple pulp or pieces
2 pints of water

Wash the apricots carefully and soak them for 2 days in water. Then add the pineapple liquid and cook gently for 1 hour. Add sugar and canned pineapple cut into dice. Boil for ½ hour or until a sample tried on a cold plate jells.

Pressure Cooked Marmalade

First stage:
7 grapefruit
2 lemons
1½ pints of water

Second stage:
6 pints of water
Sugar

Cut up fruit and cook with 1½ pints of water in pressure cooker for 10 to 15 minutes, depending on condition of fruit. Cool saucepan at room temperature and add 1 cup of sugar for each cup of fruit and liquid, then add 6 pints of water. Boil in preserving pan till sample jells.

Over the whole operation the pressure cooking method is not of great advantage as a time saver, though there is a saving in fuel.

If the proportions, 3 pints of water and 3lb. of sugar to each lb. of fruit, are kept the same, any combination of citrus fruits may be used, depending on personal preference.

Bordered Materials Have Many Uses in the Home

By NELL MACPHERSON, Field Officer in Rural Sociology, Department of Agriculture, Auckland

BORDERED materials in different weights and attractive colourings have become increasingly available recently. They have many advantages in use because the patterned border is generally printed along the selvedges and thus lends itself to a decorative finish in simple styles. The materials are suitable for a wide variety of purposes in the home.

AT present bordered materials are available in dress silks, spun rayons, heavy cottons, light cottons, seersuckers, and rayon shantungs. The lighter-weight fabrics are useful for dresses, aprons, play-clothes, and peasant-type skirts, while the heavier ones may be used for dressing-table skirts and curtains.

There are several points to watch in using bordered materials:—

1. The pattern must be carefully checked when setting on the material to ensure continuity of the border in the finished article. More material may have to be allowed for this.

2. Because the border runs along the selvedge, it may not need to be hemmed, or a smaller allowance may be made for the hem.

3. In curtains the borders may need to be run vertically rather than horizontally to obtain the necessary length.

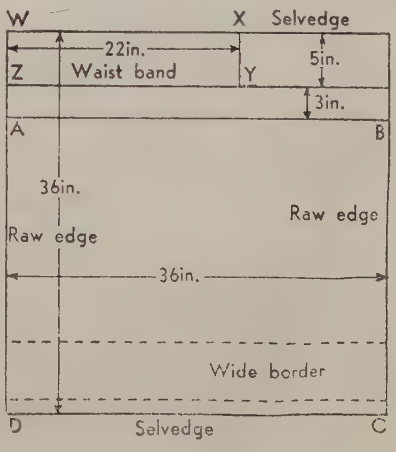
4. The strong horizontal lines produced by the border have a shortening and widening effect.

5. Simple, rather straight styles which depend on the material for their effect are more suitable in making frocks.

Apron

The apron illustrated on page 514 is fairly easily made. The materials needed are 1yd. of bordered cotton print and 1 reel of matching cotton thread. No pattern is required. Cut the material as shown in the diagram on this page and then proceed as follows:—

1. Hem along AD and BC.
2. Run a gathering thread along AB and draw it up to 21in.
3. Turn in the raw edges WZ and XY.
4. Stitch AB to YZ
5. Stitch WX down along the line of sewing to make the waist band.
6. Turn in the raw edges all round the 3in. strip and stitch down.
7. Cut it in half and insert the raw edges into the waist band at each side. Stitch firmly to hold the ties in place.

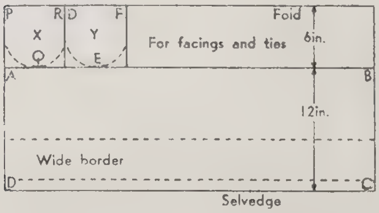


Cutting out diagram for the apron.

8. From the remainder of the material cut a pocket and stitch it on if desired.

Workbag

The workbag illustrated on page 515 is also quickly made and makes an attractive gift. The materials needed are 1yd. of double bordered material, 1 reel of matching thread, and 12 brass curtain rings.


P
R
D
F
X
Q
Y
E
Fold
6in.
For facings and ties
A
B
12in.
Wide border
D
C
Selvedge

Cutting out diagram for the workbag.

Cut out the pieces as in the diagram given above. Place the 2 pieces X over the 2 pieces Y and round off the corners as shown by the dotted line on the diagram.

Front

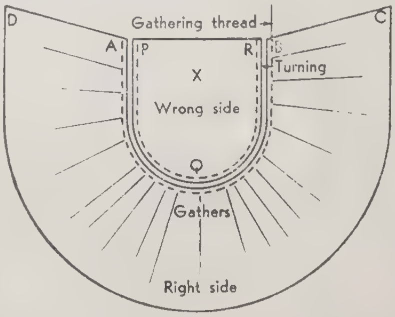
For the front the work is done as follows:—

1. Turn in ½in. seam allowance on both X pieces.
2. Run a gathering thread along AB and draw it up to fit round PQR on X.
3. Pin AB firmly round PQR on one piece of X and then place the other piece X over the top to conceal all raw edges. Pin firmly and tack.
4. Stitch down.
5. Fill the pocket made of the X pieces with scraps of woollen material or teased fleece wool for the pin cushion.

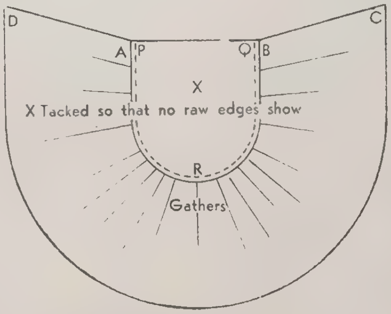
Back

The back is worked as follows:—

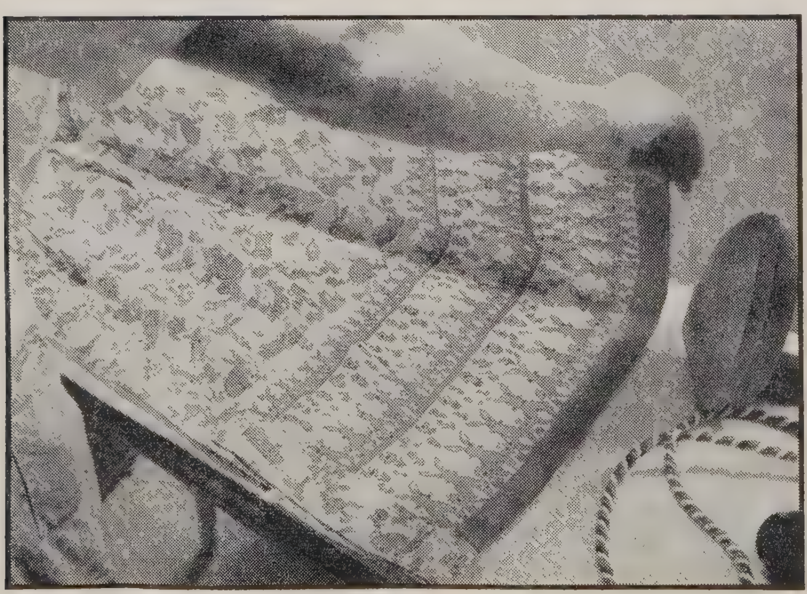
1. Turn in ½in. seam allowance round the 2 pieces Y.
2. Run a gathering thread along AB and draw it up to fit round DEF on Y.
3. Pin AB firmly round DEF on one piece Y and then place the other piece Y over the top to conceal all raw edges. Pin firmly and tack. (This is similar to stage 3 in the directions for the front.)
4. Stitch down.
5. Join the front and back sections along CD.
6. Face the raw edges of the bag with a 2in. strip cut from the remainder of the material.


D
C
Gathering thread
A
P
R
B
Turning
X
Wrong side
Q
Gathers
Right side

Skirt of workbag drawn up to fit pocket.


D
C
A
P
Q
B
X
X Tacked so that no raw edges show
R
Gathers

Skirt of workbag tacked to pocket and ready to sew.



Folding the completed apron.

Dressing-table Skirts

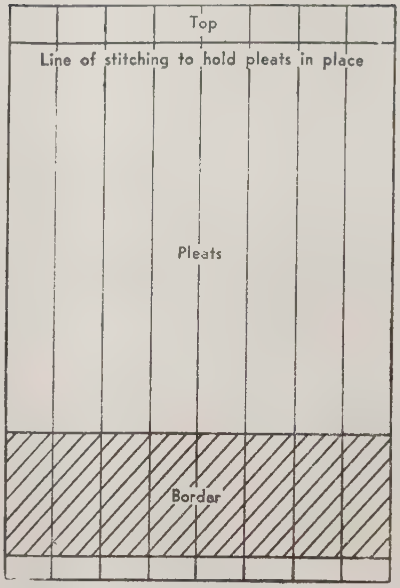

Top
Line of stitching to hold pleats in place
Pleats
Border

Diagram to show the fixing of pleats.

Dotted lines indicate where pleats are stitched

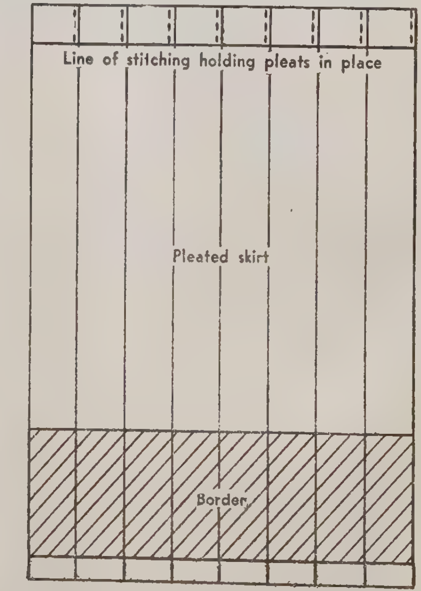

Line of stitching holding pleats in place
Pleated skirt
Border

Diagram to show the completed pleats.

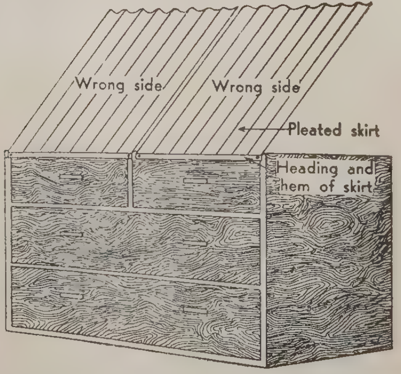

Wrong side
Wrong side
Pleated skirt
Heading and hem of skirt

Diagram to show the method of attaching the skirt to the table to conceal the heading.

7. Edge stitch round the top edge of the facing for greater firmness.

8. From the remainder of the material make a long strip to thread through the curtain rings.

9. Stitch the evenly spaced curtain rings to the facing.

Curtains

The curtains and dressing-table skirt in the illustration on this page are made from rayon shantung.

Measure the windows from the top of the architrave to the bottom of the sill and add 9in. for hems and headings for each curtain. (For many casement-type windows this will be 4ft. 6in. for each curtain.)

1. Cut the material on the straight crosswise grain at the appropriate length.
2. Turn down 3in. for a hem and heading at the top. Stitch the hem down.
3. Make a heading wide enough to take the rod or expanding wire and stitch down.
4. Adjust the length of the curtain against the window and turn up the hem. The hem finish is neater if it is hand stitched.

Dressing-table Skirts

Measure **half** the width of the dressing table and add half as much again for a gathered or pleated skirt. (Half the width of the table illustrated was 2ft. The total material allowed for the skirt for one side of the table was therefore 1yd. or 2yd. for the whole skirt, which is divided down the centre for easier access to the drawers.)

Measure the height of the table and add 3in. for hem and heading. (The table illustrated was 2ft. 8in. high. With the allowance for hem and heading this came to 2ft. 11in., so the complete width of the material was used in the skirt. As the selvedge came to floor level, no hem was made at the bottom edge.)

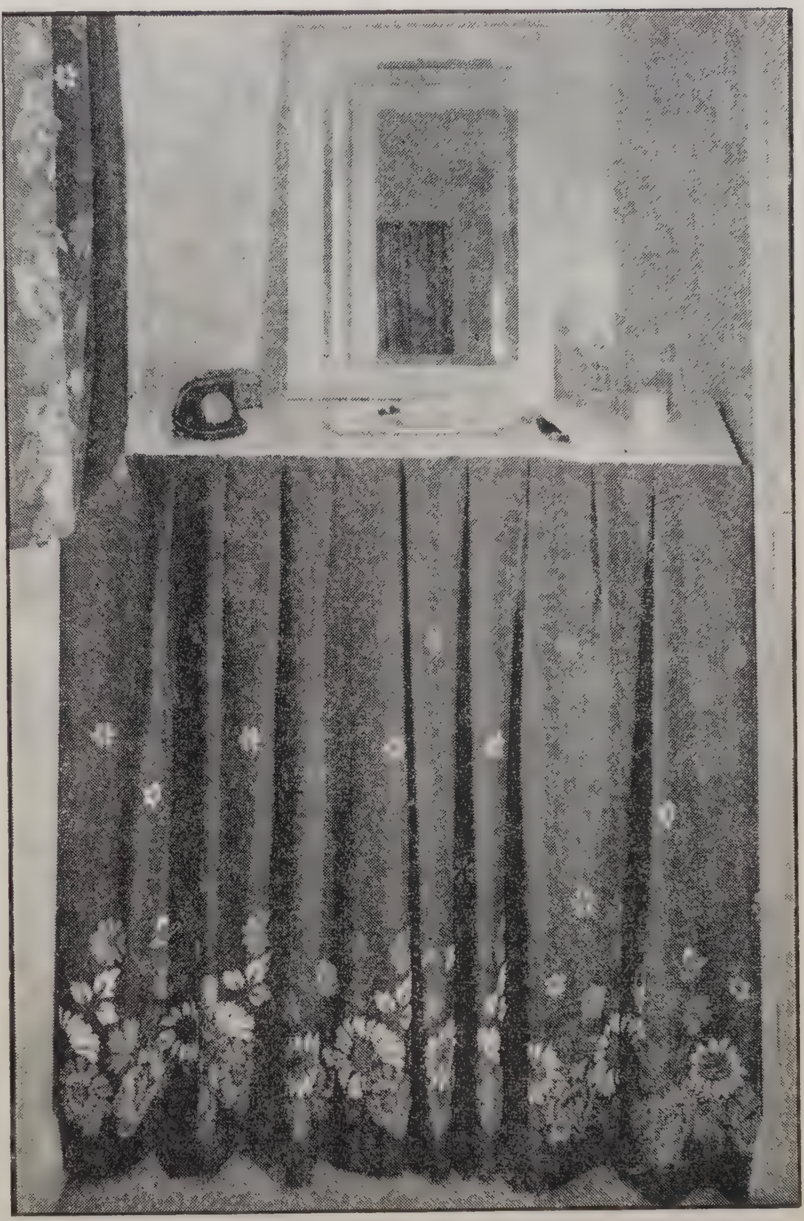
Cut a piece of material the appropriate size for each side of the dressing-table skirt.

Hem the raw edges.

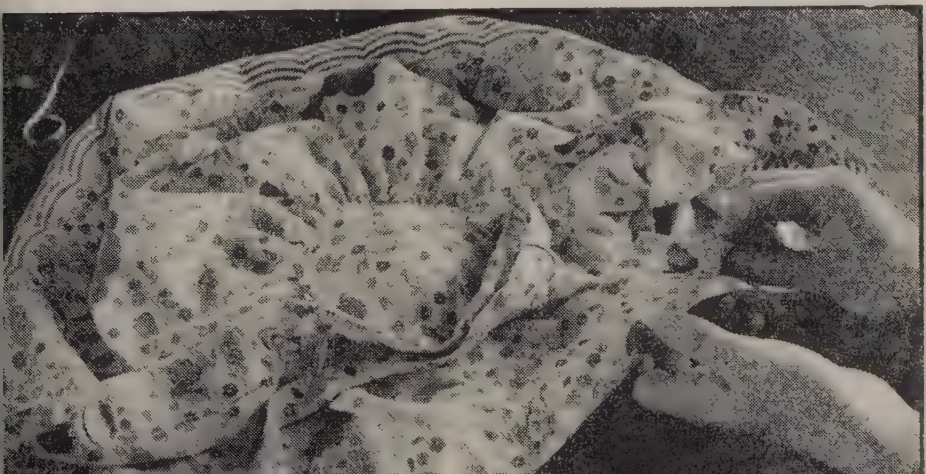
Gathered Skirt

The skirt is gathered as follows:—

1. Turn down a 3in. hem at the top and stitch.
2. Make a heading wide enough to take the rod or wire used for suspending the skirt.
3. Insert the rod or wire and adjust the fullness on the table.



Above—Curtains and dressing-table skirt to match. Below—The workbag.



Pleated Skirt

1. Take the two hemmed pieces and adjust the pleats.
2. Stitch across the pleats 3in. from the top edge to hold them in place.
3. Stitch the pleats down to this line.
4. Turn down 3in. for the hem.
5. Make a heading sufficiently wide to hold the rod or wire used for suspending the skirt.
6. Insert the rod or wire and attach it to the table so that the heading is concealed when the skirt hangs down.

On a vanity table with hinged rods the skirt may be attached to the rods with drawing pins or upholstery tacks if desired. If this is done, slightly less material is needed, as only 2in. needs to be allowed for the top hem.

All photographs by Sparrow Industrial Pictures Ltd.

Slipper Socks in Diamond Pattern

MOST people enjoy the relaxation of taking their boots or shoes off after a hard day's work, and warming their stockinged feet by a fire. This practice is often very hard on the socks, however, and may mean a lot of extra darning. A solution is socks with a felt slipper sole sewn on to them for protection. They are quite strong enough to wear round the house and yet allow complete freedom for the feet. These slipper socks, the method of making which is described below, are considered to be more comfortable than ordinary slippers and much more economical to wear.

MATERIALS: 3oz. of double knitting wool in yellow (main colour), 2oz. in scarlet, 1oz. in navy. One pair each of No. 10 and No. 12 knitting needles. Felt for soles. Embroidery silk or cotton to match one of the colours.

Measurement: Length of foot, 9½in. (or length required).

Tension: 6½ stitches to 1in.

Abbreviations: K. knit, p. purl, st. stitch(es), cont. continue, tog. together, alt. alternate, inc. increase, dec. decrease, patt. pattern, st.st. stocking stitch (1 row k., 1 row p.), yl. yellow, sc. scarlet, ny. navy.

With No. 12 needles and ny. wool cast on 59 st. and work ½in. in k. 1, p. 1 rib. Change to sc. wool and cont. in rib for a further 3½in.

Change to No. 10 needles and cont. in st.st. with yl., sc., and ny. wools, working 29 st. for instep in Fair Isle patt. from chart, knitting odd numbered rows and purling even numbered rows. The background is in yl. and the Fair Isle patt. in ny. and sc. Thus the first 4 rows will be as follows:—

First row: K. 15 yl., then as chart (1 yl., 2 sc.) twice, 4 yl., (1 sc., 1 yl.) 4 times, 1 sc., 4 yl., (2 sc., 1 yl.) twice, then 15 yl.

Second row: P. 15 yl., then as chart 2 yl., 5 sc., 2 yl., 1 sc., 1 yl., 1 sc., 5 yl., 1 sc., 1 yl., 1 sc., 2 yl., 5 sc., 2 yl., then 15 yl.

Third row: K. 15 yl., then as chart 3 yl., 4 sc., (1 yl., 1 sc.) twice, (1 yl., 2 sc.) twice, (1 yl., 1 sc.) twice, 1 yl., 4 sc., 3 yl., then 15 yl.

Fourth row: P. 15 yl., then as chart 4 yl., 2 sc., (1 yl., 1 sc.) twice, 1 yl., 7 sc., (1 yl., 1 sc.) twice, 1 yl., 2 sc., 4 yl., then 15 yl.

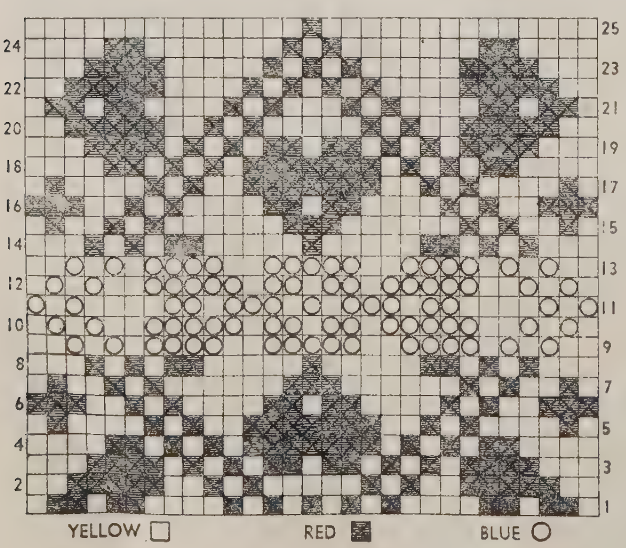


Chart for working pattern.

Cont. thus, working through chart until 18th row has been completed.

Shaping

Next row: K. 15 yl., work next 29 st. as 19th row of chart, k. 1 yl., turn.

Next row: P. 1 yl., work next 29 st. as 20th row of chart, p. 1 yl., turn. Cont. on these 31 st. only for instep, working another repeat of rows 1 to 20 of chart with 1 st. each end in yl., until 3rd repeat has been completed.

Now work one more repeat of chart, this time working rows 1 to 25.

Break off sc. and ny. wools and cont. with yl. only. (Make any required adjustment in length here.)

Next row: P. 5 (p. 2 tog., p. 8) twice, p. 2 tog., p. 4 (23 st.).

Shaping the Toe

Cont. in st.st., dec. 1 st. at each end of every alt. row until 12 st. remain. Leave st. on a spare needle.

Return to remaining st., place both sets of 14 st. on to 1 needle. Cont. on these st. in st.st. with yl. wool, dec. 1 st. at each end of alt. rows until 12 st. remain. Now inc. 1 st. at each end of alt. rows until there are 28 st. Cont. straight for same length as top part of foot. Shape toe as given for top part. Graft the 2 sets of 12 st. tog.

Making Up

Press work lightly on wrong side with a warm iron and a damp cloth. Join foot and leg seams.

Cut felt to fit underpart of foot as far as side seams, then cut toe and heel pieces. Seam together and turn right side out. Tack in position, cutting out the toe piece in two points to follow the line of the pattern, then buttonhole stitch to the knitted fabric all round.

Use for Old Gramophone Needles

OLD gramophone needles make excellent tacks for holding the backing into a picture frame. In this case the lack of a head is an advantage. The needles may be driven in with a pair of pliers so long as the outer edge of the frame is protected with a piece of folded cardboard from damage by the pliers. When necessary the needles may be removed with the same tool.

—EIRENE E. UNWIN,
Field Officer in Rural
Sociology, Department
of Agriculture,
Christchurch

Proper Care of Kitchen Knives

A GOOD selection of kitchen knives is invaluable for reducing the time and effort required for food preparation, but the knives must be wisely chosen and carefully looked after. A few points to look for in selecting good knives and some precautions necessary to get lasting value from them are described here by Helen Paine, Field Officer in Rural Sociology, Department of Agriculture, Wellington.

[Sparrow Industrial Pictures Ltd. photo.

KNIVES are probably the most misused equipment in the kitchen. They may be specially designed for cutting bread, slicing meat, or peeling vegetables, but they are often used for any purpose at all, including opening tins and cutting wire. Once it has become blunt a knift is a source of annoyance instead of a valuable piece of labour-saving equipment. To give lasting satisfaction a knife in the first place must be a good one, specially selected for the purpose for which it is needed, and it must always be kept sharp, used correctly, and stored carefully.

Selection of Knives

To pay for good quality in knives is worth while, but it is not always easy to tell at a glance which knife is likely to be a good buy and which is not. It is wise, therefore, when there is a big selection, to buy from a reliable firm which will give good advice as to the best manufacturers.

Today blades are all made from stainless steel, which eliminates the drudgery of cleaning and scouring, but such blades require more careful handling and sharpening than blades made with ordinary steel. The two types of stainless-steel knives on the market at present are of hollow-ground, high-quality steel or the ordinary tempered steel, which can be of varying quality. The hollow-ground knife, which is sharpened to a razor edge, is the more delicate and needs to be used with the greater care, but good knives of either type possess some of the same characteristics.

A knife should be well balanced if it is to be manipulated without strain, so the weight of the handle and blade must always be adjusted carefully. The balance can be tested easily before the knife is bought by holding the knife the way it is to be used. The blade should also have good "spring"; at least two-thirds of the blade should be flexible and only the one-third next to the handle should be rigid. When the blade is bent it should form a slight curve. Cleaving knives specially designed to be used for chopping meat with bones and hard vegetables like pumpkin are more rigid than the fine knives used for peeling and slicing.

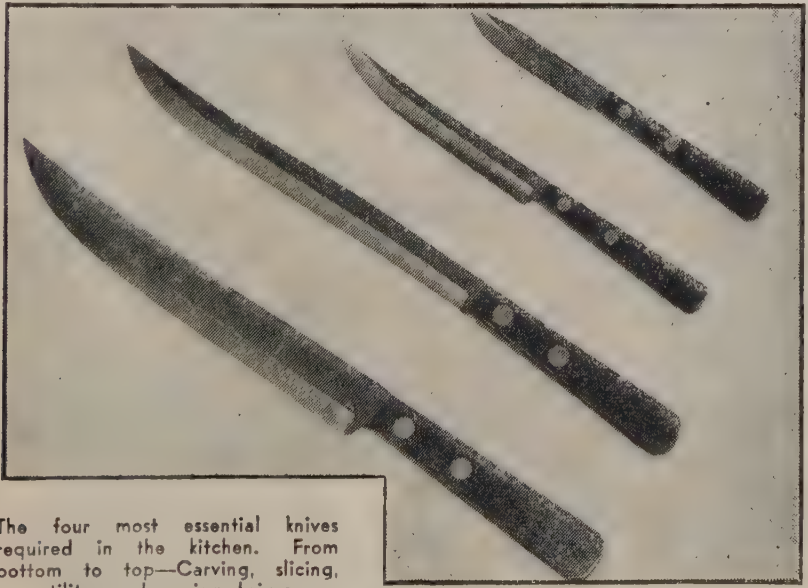
Knife handles can be made from a wide variety of materials, but the most usual are of wood and composition. Handles of very hard, fine-grained rosewood are resistant to moisture and will not stain or warp, and some composition materials, in a variety of colours, can be moulded on to the knife to form a solid handle without joins or crevices to catch dirt. Other handles of plastics and painted wood are common, and metal and leather are less usual.

A good knife can often be recognised by the way in which the handle and the blade are joined. In a well-constructed knife the broad shank of the blade extends at least half and sometimes all the way down the handle. The handle should be fastened to the blade by at least two good-sized rivets; sometimes small rivets are used, but these are more likely to split a wooden handle than large ones. The handle should be fixed to the blade so that there are few cracks and crevices in which food particles can collect.

Most Useful Knives

It is not the number of knives available, but the careful selection of the right knife for a particular need that makes the housewife's task much easier. Knives are classified according to shape and length of blade. Though many other knives are made for one particular purpose, the four described here are essential and are the most useful for the many varied jobs to be done in the kitchen.

The paring knife has a short blade 3 to 3½in. long and a correspondingly short handle, which makes it easy to manipulate without strain on the finger muscles. It is useful for all the delicate work that requires the use of the tip of a knife, such as small cutting



The four most essential knives required in the kitchen. From bottom to top—Carving, slicing, utility, and paring knives.

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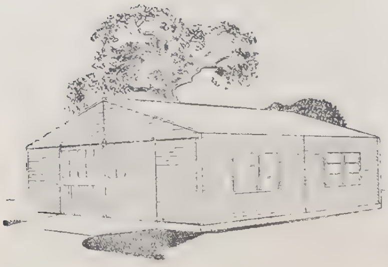

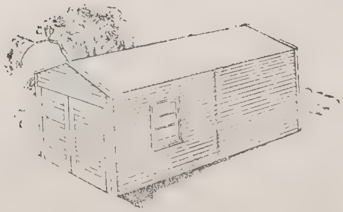

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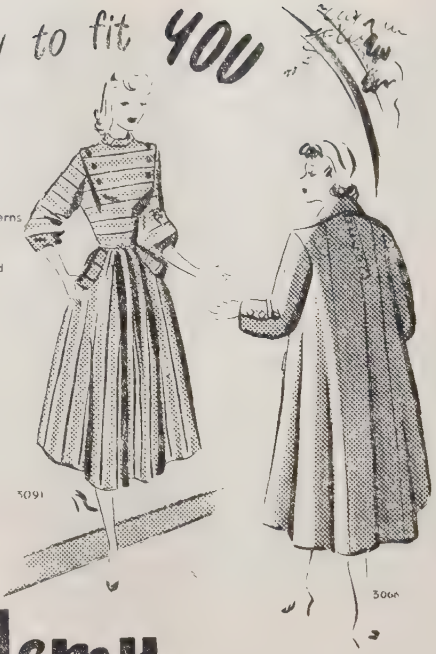

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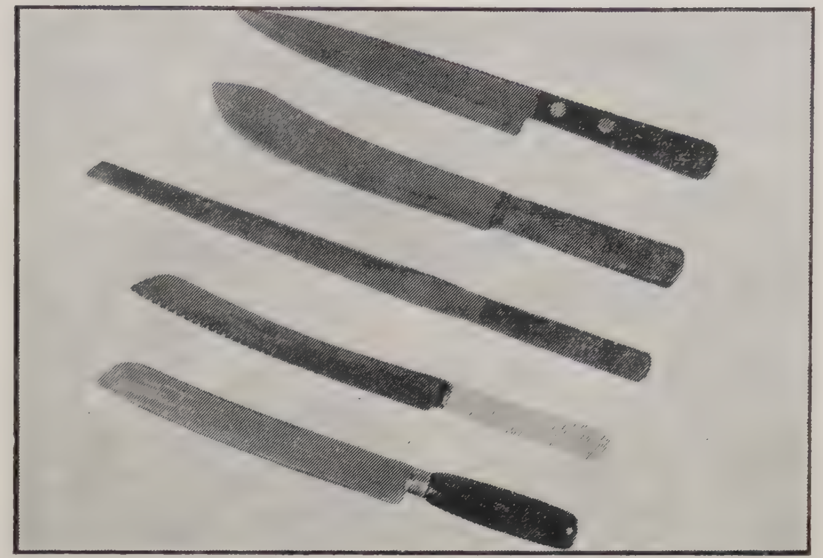


Special knives. From bottom to top—Serrated and scalloped bread knives and ham, kitchen, and French chef's knives.

jobs, peeling of fruits and vegetables, and removing of eyes of potatoes and any small defects in fruits and vegetables. If a special peeler is used, the paring knife is still useful for slicing small fruits and vegetables and detailed work such as making celery curls and tomato flowers. The closer the hand is to the tip of the blade the easier it is to work with the knife, which should be held so that the handle is under the knuckle joints of the four fingers, with the blade firmly guided by the index finger.

The utility knife can be used for almost any purpose. The blade is usually 5 to 7in. long and is most suitable for cutting up fruits and vegetables that are too big for the paring knife to cut easily. It is excellent for peeling any thick-skinned fruits, as the blade, though longer and thinner than that of the paring knife, is as easily controlled and will cut a larger surface. This knife is excellent for cutting fish off the bone, slicing cooked rabbit or chicken off the bone, slicing a difficult, small joint of cold meat, and many other jobs.

The slicer: This is a fine knife with a narrow flexible blade that tapers slightly at the point. Its straight edge will cut the finest slices of cold meat. It is excellent for cutting thin slices of cake and bread for sandwiches, but the crusts should be removed first, as the knife edge is very easily damaged. The slicer is also useful for cutting large fruits into slices. Once the peel has been removed from grapefruit or pineapple the slicing knife is the most suitable for cutting the fruit with the minimum loss of juice.

The carving knife, used mainly for carving roasts in the dining-room, has also some uses in the kitchen. It is a long knife, but its sturdy blade is less flexible than that of the slicer. The point has a long thin curve to assist it in getting round the bones. To enable it to cut hot, yielding meats with ease, the blade is not made too pliable.

Special Knives

Once the basic necessities such as paring, utility, and slicing knives for the kitchen and a good carving knife for the dining-room have been procured, the housewife later may want to add to her collection. The following are among the most useful of the special knives:—

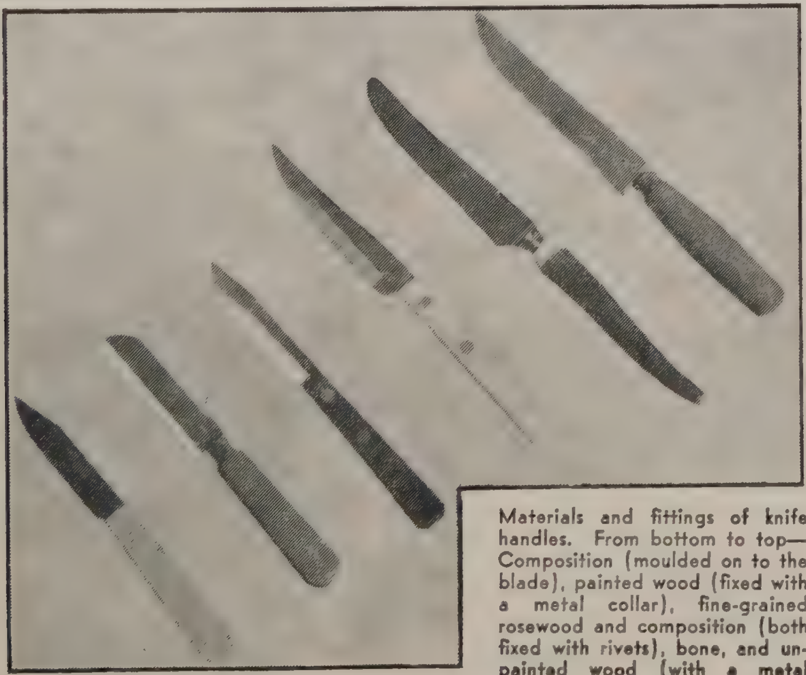
The French chef's knife: This long-bladed knife has a straight cutting edge which tapers gradually to a point. The back of the blade is also straight and is in line with the top of the handle. This knife is specially made for chopping and dicing foods. Because the handle is in line with the top of the blade, and the blade is deeper than the handle, as can be seen in the illustration of the top knife in the upper photograph on this page, the fingers are not interfered with when the whole blade is used in a chopping action. Such foods as onions, celery, nuts, parsley, carrots, and meat can be cut up quickly and easily. The French knife is also the right tool for slicing large vegetables such as swedes and marrows. Chopping is done most quickly if the tip of the knife is kept on the board and only the handle is raised. The weight of the knife does the chopping easily.

The butcher's knife has a very heavy blade for cleaving joints. It is stronger and less flexible than any other kitchen knife.

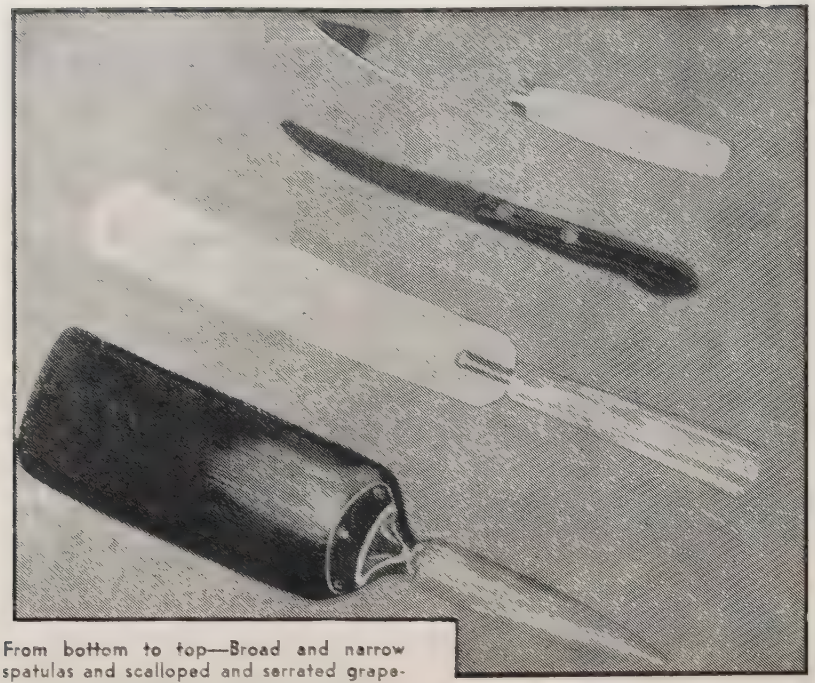
Grapefruit knives usually have curved, double-edged blades, sometimes serrated or scalloped. They are used for loosening grapefruit segments from the rind and membrane.

Bread knives: The serrated and the scalloped bread knives are specially made to save the ordinary knife, which is rapidly dulled when used for cutting bread. The serrated bread knife has groups of fine ridges running in alternate directions. These are self-sharpening and usually are satisfactory, except that they tend to tear fresh bread apart rather than cut it in slices. The scalloped knife is less likely to tear the bread and is very easily cleaned, but it must be sharpened in the ordinary way.

The spatula, sometimes classified as a kitchen knife, is a very useful piece of equipment. Its blade is not sharpened for cutting, but has rounded edges and is extremely flexible. It is used for removing cakes from a tray, for icing cakes, and for folding egg whites into any food mixture. The spatula is most easily manipulated if it is rigid close to the handle and extremely flexible for the rest of its length.



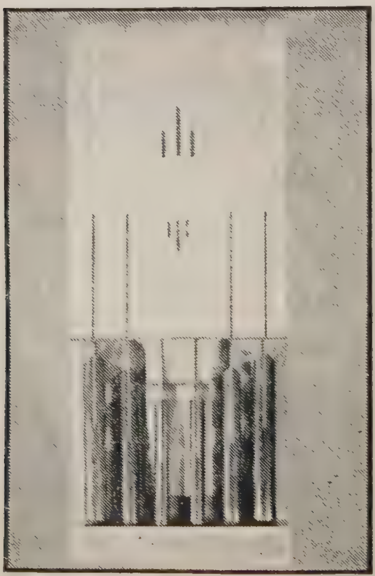
Materials and fittings of knife handles. From bottom to top—Composition (moulded on to the blade), painted wood (fixed with a metal collar), fine-grained rosewood and composition (both fixed with rivets), bone, and unpainted wood (with a metal collar).



From bottom to top—Broad and narrow spatulas and scalloped and serrated grapefruit knives.

Sharpening of Knives

Even with the best possible selection of knives and the most careful handling frequent sharpening is necessary if the knives are to keep their efficiency. A tempered-steel knife is best sharpened with a steel. This method requires a little practice, but if done correctly it soon becomes very easy. The steel should be held in the left hand and the knife in the right, tilted slightly so that only the edge touches the steel. The knife is then drawn toward the body alternately on the upper and under sides of the steel.



Good knives should be stored carefully. This wall holster is convenient and protects the blades.

A special wheel sharpener is available for sharpening this sort of knife. It gives a good edge very quickly and can be mounted on a wall, where it is very easy to use.

The hollow-ground steel knife has a more delicate razor edge than the tempered-steel knife and is made of very hard steel. The ordinary steel-knife sharpener is not sufficiently hard to make an impression on the steel, and unless the wheel sharpener is specially made for this type of knife it is not safe to use it on the fine edge. The oilstone is the most efficient and reliable instrument for sharpening the hollow-ground knife.

Storage

Knives should be stored carefully so that their edges do not become dulled with constant rubbing against each other. Most good knives are sold with cardboard sheaths protecting the blades. As long as the sheaths last the knives can be kept together in a drawer, but as the sheaths will wear out long before the knives, a more permanent method of storing the knives is necessary. A holster on the wall in which each knife has a place is perhaps the most satisfactory method, as the required knife is easily selected. A rack made from a narrow shelf with slots for the knives to fit into is perhaps the easiest form of storage in a kitchen. Another simple alternative is to attach loops of leather to a wall, making them sufficiently large for the knife blade to slip through, but too small for the handle. A rack with hooks is also useful if the knives have holes in the ends of the handles, but the knives are not as accessible on hooks as they are on the ordinary racks.

A drawer with special compartments or sockets for each knife is a very good idea, but quite difficult cabinet-making is required. If a new kitchen work bench is being built, a knife rack can be fitted into it so that the knife handles protrude above the surface of the bench with the blades out of sight below. With the rack at the back of the bench it is simple to protect the knife blades by building a shield round them to separate them from articles in the cupboard below the bench; this will also prevent anyone being cut

Good knives will give lasting service only if they are sharpened and stored properly and used with care. The ordinary tempered-steel knife will stand rougher treatment than the hollow-ground knife, which should never be used for ordinary work such as cutting string or paper or even bread, as its edge is dulled very easily. Even the stronger knives should not be used for cutting rope or wire, and knives should never be used for prising up bottle-tops or opening tins. Such treatment would probably snap a hollow-ground knife and ruin the blade and tip of any other.

A good knife should always be used on a board and never on metal, glass, enamel, or any other hard surface that will dull its edge

◆

Cutting Dressmaking Patterns

THOSE with little experience of dressmaking often find that laying the pattern on the fabric and cutting out the garment are the hardest parts of the job. Once these difficulties are overcome the sewing seems quite easy. The following points should prove helpful.

Fit the pattern against the figure and make rough adjustments for size, especially length, as these will influence pattern layout and simplify later fitting.

Each pattern piece will be marked with arrows or a line of perforations to show the straight grain. When the pattern pieces are being laid for cutting these marks must be placed along the thread of the material parallel to the selvedges. Disregard spots or stripes printed on the fabric, as they are not always spaced accurately. A woven pattern can be followed, however.

Secure the pattern by pins placed at right angles to and not parallel to the edges.

Wherever possible cut out on a double thickness of the material folded selvedge to selvedge, as this ensures that sleeves, sides, panels, and fronts will face. If it is necessary to cut two such pieces from single thicknesses, cut one, and, with the pattern pinned in place on it, turn it over on to the remaining material so that the cut-out section is on top and the paper pattern is between the two thicknesses of material.

Use large sharp scissors for cutting; small ones are never satisfactory.

Mark all notches by cutting out from, not into, the pattern.

—*NORMA K. METSON,*
formerly Field Officer in Rural Sociology, Department of Agriculture, Wellington

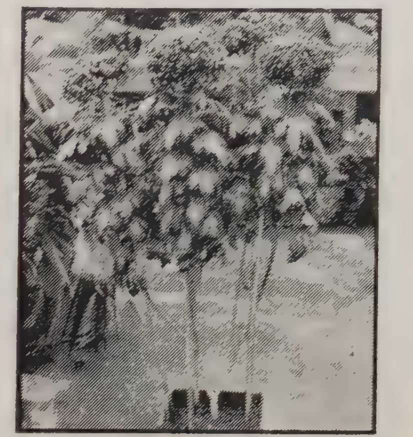
◆

Chrysanthemums Can Give a Brilliant Display in the Flower Garden

THE chrysanthemum is highly regarded by gardeners and flower lovers and is generally considered, with the rose and the daffodil, among the world's three most popular flowers. It provides a wealth of colour in summer and autumn, and in this month's article for the flower gardener C. K. Ellis, Horticulturist, Department of Agriculture, Dunedin, describes its culture both in pots and in the flower borders.

BORDER chrysanthemums normally are left in the ground for up to 3 years. After this the plants begin to deteriorate and do not give as vigorous growth or as brilliant floral displays as do younger plants. For this reason it is wise every second or third year to replace the old plants with new ones raised from cuttings. An alternative is to lift the old stools or clumps and divide them, replanting only the younger and more vigorous pieces from the outsides. In most parts of New Zealand October is the best month for this operation. The young pieces should be planted back immediately.

The most satisfactory plants however, are those raised from cuttings. The new roots are formed on new growth, and this gives them a greater ability to absorb food and water than that of divided pieces or "Irishmen's cuttings", which have older "wood" which is hardened and not capable of such rapid absorption in the initial stages of the new year's growth. The cuttings may be taken during spring from the initial growths of the stools in the borders, but to obtain cuttings earlier many gardeners prefer to lift the stools, pot or box them up, and give them the protection of a cold frame or greenhouse, thus inducing earlier growth of the new shoots and therefore earlier availability of cuttings.



Exhibition chrysanthemum Pocketts' Maroon on which severe disbudding has left only one high-quality bloom on each stalk, which has a separate stake.

Anemone-centred chrysanthemum R. G. Castles.

Single chrysanthemum Margaret Milligan with numerous good-quality flowers resulting from moderate disbudding. Each of two stakes has several flower stalks tied to it

Cuttings about 5in. long should be taken from sturdy growths. The leaf area should be reduced by removal of at least the lower two pairs of leaves and perhaps even the top halves of the remaining leaves. The growing point must be intact, for most of the hormones required for callus formation and rooting are produced in the growing region. The cut at the base of the cutting should be made below and as near as possible to a leaf joint

An excellent medium in which to root chrysanthemum cuttings consists of equal parts of river sand and good loam, which should be passed through a ⅜in.-mesh sieve before being mixed This mixture is spread evenly to a depth of about 5in. in boxes in a cold frame or in glass-protected boxes in the open air, firmed down, and watered thoroughly before the cuttings are inserted in it to a depth equalling two-thirds of their length.

While the cuttings are taking root they must be kept moist and protected from draughts and intense sunlight to prevent any tendency for them to dry out. The rooting medium must be kept moist, and during very dry spells the cuttings should be syringed with cool water once a day. Treatment of the cuttings with root-promoting hormones before inserting them in the medium is helpful, but not necessary, as cuttings of chrysanthemums normally take root with reasonable ease.

About 6 weeks from the time of insertion good roots should have been formed, and at this stage the cuttings can be removed from the rooting medium and placed in small pots or boxes containing a mixture of 7 parts of good fibrous loam, 3 parts of leaf mould or well-decayed compost, and 2 parts of sharp sand. The containers of rooted cuttings should be either placed back in the cold frames or protected by a sheet of glass for a couple of days. After this the cuttings should be gradually hardened off to outdoor conditions by increasing in stages the amount of air allowed to circulate about them

As the plants become hardened and begin to show vigorous new growth preparations must be made for planting out. A week or 10 days before planting out is to take place the growing tip of each cutting should be nipped out to encourage production of several leading shoots. By the time planting out takes place each plant should have a good clump of roots and be showing signs of branching into several top shoots. No definite time for planting out can be given for the whole of the Dominion, but about November is considered generally the most favourable time. In the really mild districts October or even September would not be too early.

Soil Requirements

Soil requirements for border chrysanthemums are fairly high, for they are gross-feeding plants and do not thrive unless provided with adequate food. To plant them in a border which has not been manured adequately for many years is to court failure. The ideal border is one which can provide reasonably fertile soil of good texture to a depth of not less than a foot and to which has been added an adequate supply of a general flower garden fertiliser. In such a border chrysanthemums should give one of the most brilliant floral displays of the gardening season.

Chrysanthemums, like many other garden plants, are seen to best advantage when grown in mass in a border given entirely to their culture. That is not done very often in New Zealand home gardens, but an endeavour should be made to place them in as large groups as possible rather than to scatter individual plants here and there throughout the border.

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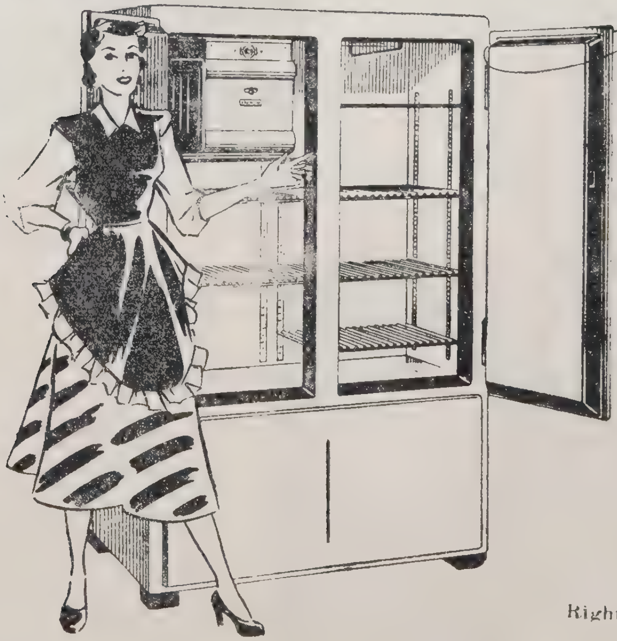

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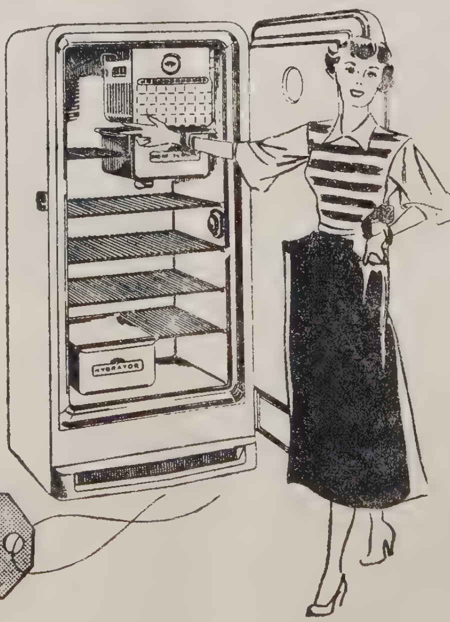

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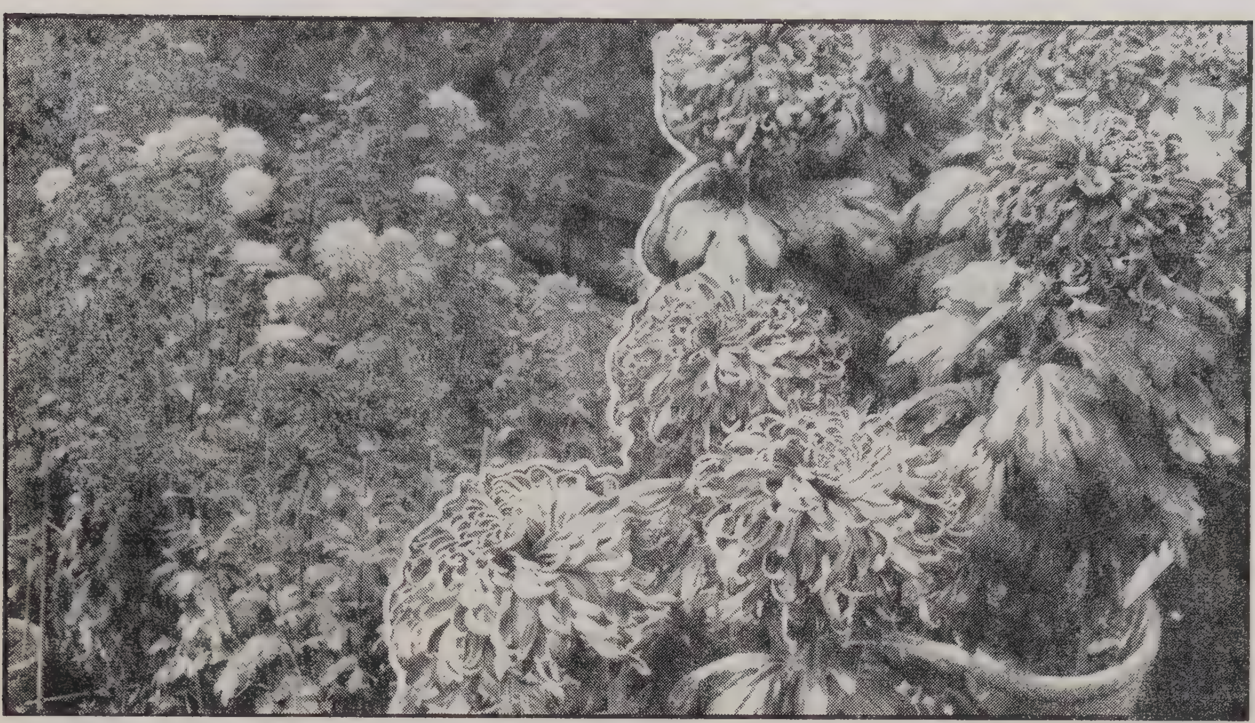


Chrysanthemums are seen to best advantage when grown in groups, as in these views inside greenhouses.

The young plants must be set deeply enough in the soil to keep them firm throughout the growing season, but they should not be planted much deeper than the old soil mark left when they were lifted from the boxes.

Staking Chrysanthemums

Under normal conditions growth after planting out should be rapid, and in a very short time the plants need staking. Two methods of staking chrysanthemums are satisfactory.

One is to drive a stout stake into the soil close to the main stem of the plant and in a position which will be about the centre of the growth area. As the stems grow each is tied back at intervals to the single stake and at flowering time the stake is almost completely hidden by the foliage and flowers.

The single-stake method is rather risky in districts subject to frequent gusty winds. There a separate stake should be provided for each main stem growth on the plant and the stems tied back at intervals of, say, 8 or 9in. during the growing season.

In all but the most favourable conditions border chrysanthemums must be staked. If the stakes are equal in length to the expected maximum upward growth of the variety, the tops of the plants will not be blown off at flowering time and no ugly extensions will need to be tied to the stakes.

Subsequent Culture

Culture of the plants from the time of planting out consists of little more than keeping the soil about the plants well hoed to conserve moisture and destroy weeds. During dry weather the plants need to be thoroughly watered because they do not resist drought well.

An additional topdressing of fertiliser can be given about midsummer if thought necessary.

Disbudding Chrysanthemums

For best results some disbudding is necessary. Disbudding is the term applied to the removal of surplus flower buds. It can be done when these buds are little more than the size of peas either by pushing them sideways until they drop off or by nipping them off with the nails of the thumb and forefinger. Disbudding causes the production of fewer flowers, but they are larger and better.

Should few additional side branches tend to form by about the middle of the growing season, the main shoots should again be "stopped" by pinching out the growing point once more. This induces the formation of a greater number of shoots. The greater is the number of shoots, the greater will be the number of flowers, and if the gardener judiciously thins the flower buds on these shoots, he can confidently expect a fine display of good-quality blooms. Heavy disbudding certainly gives excellent flowers, but it also reduces their numbers considerably and shortens the flowering season.

Wintering Chrysanthemums

As the flowering season proceeds all dead flowers should be removed. When the plants have died back considerably they can be tidied up by cutting them back to within a few inches of the soil; in this condition they will stand through the winter and, with the help of a little cultivation and the application of fertiliser, be ready for a second fine display in the following season.

Exhibition Blooms

When chrysanthemums are to be grown for exhibition, and this applies particularly to the large, double-flowered Japanese varieties, the treatment after the cuttings have rooted is somewhat different and a little more complicated. Instead of being set out into borders the plants are potted up into large flower pots or even into kerosene tins. Some growers prefer to grow them in beds in a greenhouse

The soil mixture used is basically the same as that used when boxing up the rooted cuttings, but it may have added to it ½ bucketful of well-decayed animal manure or 6oz. of general garden fertiliser to a bushel of soil. The plants are grown outside in their pots until the flower buds begin to show colour. Stakes for potted chrysanthemums are best inserted down the sides of the pot immediately opposite each main stem; double varieties should have about a half a dozen stems to a well-grown plant. As the season progresses these main shoots are tied further and further out, until before flowering time each stem is closely tied to its own stake.

Exhibition varieties are usually grown with only one flower to each stem and therefore disbudding is severe. As the bud borne at the apex of the stem begins to swell, liquid manure is given once or twice a week to each plant. Immediately the flower bud shows colour and begins to open, liquid feeding should be reduced to about half the previous quantity and the plant moved under cover to avoid frost or rain damage to the bud. Under these conditions the flowers of most of the exhibition varieties will reach perfection.

Bulbs grown in pots or pans for decoration in the house should be watered sparingly until the flower buds appear, thus ensuring that the length of the leaves will not be greater than that of the flower stalk at time of blooming. After the bud has appeared above the soil water may be applied more liberally, but the soil must never be allowed to become waterlogged.

Drainage of the soil is a factor well worth consideration at this time of year. Especially in a new garden, a good plan is to dig a few holes here and there and leave them open during the wettest season of the year so that, if there should be any waterlogging below ground level, it can be seen and remedial steps planned. Very few plants can tolerate waterlogged soil, even for a short period.

Frosts and thaws are advantageous on heavy clay soils in that they break a cloddy condition down to one of fine tilth. For this reason such soils are improved by being left dug in late autumn or winter without further cultivation until required in spring. However, this breaking up or loosening effect is a disadvantage to newly planted shrubs, for it tends to loosen the soil about the roots; in such circumstances the soil should be trodden down again after each series of frosts.

Gladioli may be planted now in the milder northern districts. July is too early to plant flowering-sized corms in most other parts of New Zealand, but cormlets may be planted now so that they have the longest possible growing season. They should be sown 1 to 2in. apart and about 1½in. deep.

Greenhouse plants such as gloxinias, streptocarpus, cyclamen, and tuberous begonias can be propagated from seed sown in July. Boxes or trays should be filled to within an inch of the top with a finely sieved compost and watered thoroughly through a fine rose. The seed is sown thinly over the surface and, if it is covered with soil at all, a very light and finely sieved layer is sufficient. A sheet of glass should be placed over the box and the whole covered with brown paper to conserve moisture and exclude bright light. The boxes should be inspected frequently, and as soon as the seedlings have appeared the glass and the paper must be removed or the small plants will become drawn.

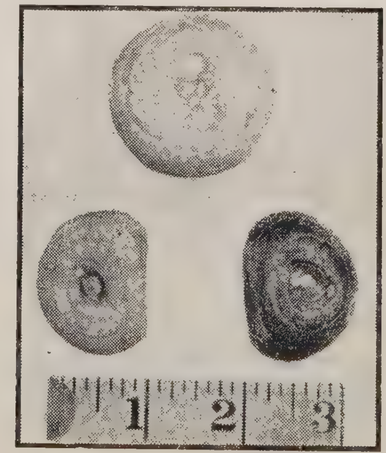
Iceland poppies require regular inspection from now on for symptoms of the virus disease known as spotted wilt. Infected plants never recover and are best removed from the soil with a trowel and burnt. Washing the hands thoroughly after tending infected plants and before handling healthy ones helps to reduce spread of the disease. The following description of the symptoms of the disease is extracted from "A Textbook of Plant Virus Diseases", by Kenneth M. Smith:—

> The first symptom is a clearing of the veins of the youngest leaves. These leaves become somewhat twisted, cease growth with the appearance of symptoms and gradually turn yellow. The whole centre of the plant acquires a pallid, stunted appearance. In affected field plants, where the rosette of leaves is usually more vigorously developed than in pot plants, a bunched habit is acquired due to the stunting and yellowing of many central leaves.

[*Douglas Elliott photo.*

Tuberous begonias can be grown outdoors in a sheltered, partly shaded corner. They can be raised from seed sown in July.

> Frequently purplish blotches appear on some of the yellowed leaves or on their mid-ribs or petioles, and a necrosis [dying of the tissue] may set in which destroys the petiole while leaving the leaf blade unaffected. Although diseased plants usually remain alive for weeks in a stunted condition, a rapid extension of the necrosis seen on the petioles sometimes causes the sudden death of the plant. The flowering stems of affected poppies are frequently much twisted and bent over; when they do grow erect they are shorter than normal, more sappy and brittle, and the buds frequently open badly. The opening of the bud may be delayed until after erection from the recurved position, so that the tip of the bud points vertically upwards, a condition not seen in healthy poppies. The sepals, instead of lifting normally from the receptacle, often confine the petals so long that they burst out laterally. On the flowering stems of many affected plants water-soaked areas may appear from which a drop of milky-white latex exudes. This soon becomes brown on contact with the air and dries to a small hard pellet. The exuding of a brownish drop of liquid from necrotic patches on the leaf petioles or mid-ribs in their early stages also occurs at times.



Gladioli may be planted in July in the milder northern districts. These corms have been husked, the concentric scars showing where the husks (the previous year's leaf bases) were attached to the corms. One or more of the eyes on top of each corm will grow next season and produce a shoot and flower spike, at the base of each of which a new corm will develop. A straight side to a corm shows that two corms grew side by side on top of the corm which was planted.

Japanese irises (*Iris laevigata*) are fibrous rooted and may be divided and replanted during July. They need a soil which is moist all year round, but not necessarily waterlogged or boggy, and rich in organic matter.

Lawn aeration not only improves the physical condition of the soil, but also promotes root growth and thus encourages a more vigorous turf. Aeration can be obtained by pushing a garden fork in every few inches as far as it will go and drawing it out without any levering.

Roses should be pruned in July in all but the coldest districts where frosts may kill any induced new growth or the ends of pruned branches, thus ruining the shape of the bushes. For ordinary garden display all young shoots should be cut back to within 9 to 12in. of their bases and side shoots and all old, dead, or weak shoots removed. For exhibition blooms much harder pruning is needed, but this results in fewer blooms and a less shapely bush and cannot be recommended for the home garden.

Seed of quite a number of plants suitable for bedding displays should be sown under glass in July. Among them are antirrhinums, *Verbena venosa*, calendulas, lobelias, East Lothian stock, nemesia, *Torenia fourneri*, and *Phlox drummondi*. The method of sowing is the same as that outlined for greenhouse plants except that the compost need not be so fine and the seed should be covered more heavily.

Shrubs which flower on the current season's wood can now be pruned by cutting back to within a few inches of the older stems all shoots which grew and flowered during the previous season. This treatment administered annually ensures a constant supply of new flowering shoots and prevents the shrubs tending to become straggly. A few of the shrubs which should be pruned thus are *Ceanothus* Gloire de Versailles, *Spiraea japonica* var. Anthony Waterer, *Clematis jackmanni*, and *Buddleia variabilis*.

Sweet pea seedlings raised from seed sown in June or earlier and germinated in a frame or greenhouse should now be hardened off gradually by being given more air and less protection. They may be planted out in the milder districts, 15in. apart if they are to be grown for exhibition blooms and 4 to 6in. apart for mass display.

Other Work for the Month

Thin to 8 to 9in. apart **annuals** sown in the borders in autumn.

Continue planting out **bedding plants** in the milder districts.

Take cuttings of **perpetual-flowering carnations** under glass.

Remove dead fronds from **ferns** and spread a layer of compost over the roots.

Plant hardy herbaceous **perennials** such as helenium, rudbeckia, kniphofia (red-hot poker), and gaillardia.

Be careful not to overwater **pot plants** at this time of year. They do not take up much water during winter and the soil can easily become waterlogged.

If the soil is wet and cold when **trees and shrubs** arrive from the nurseryman, heel them in until better conditions for planting return.

Attractive Jersey for a Girl

AN attractive jersey with an unusual design, suitable for a girl, can be made by following the instructions given in this article. The main colour is black, with red as the contrasting colour for the design. Materials required are: 11oz. of 4-ply wool in main colour (black), 1oz. of 4-ply wool in contrasting colour (red), and four No. 9 and four No. 12 knitting needles with points at both ends.

THE jersey's measurements are: Length 24in.; bust 35in.; and sleeve seam 18in. Tension is 6½ stitches to 1in.

Abbreviations used are: K., knit; p., purl; st., stitch; inc., increase; dec., decrease; st. st., stocking stitch; patt., pattern; cont., continue; rep., repeat; beg., beginning; tog., together; mn., main colour; c., contrasting colour.

The Back

Using two No. 9 needles and mn. wool, cast on 116 st. and work in rib thus:—

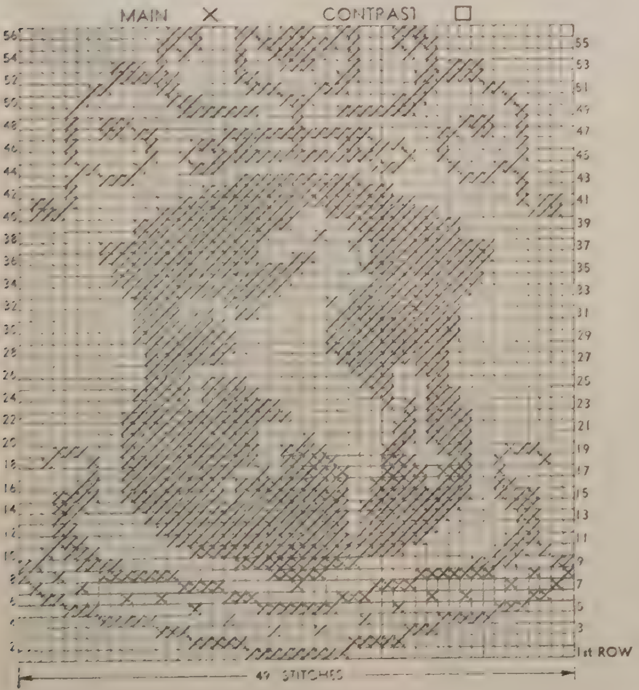
First row: K. 1, * p. 4, k. 1. Rep. from * to end. Second row: P. 1, * k. 4, p. 1. Rep. from * to end. Rep. these two rows for 1in., ending with a second row of rib, and inc. 1 st. at the end of the last row (117 st.). Cont. in st. st. (1 row k., 1 row p.) until work is 16in. from cast-on edge.

Shaping the armholes: Cast off 4 st. at beg. of next 2 rows, then dec. 1 st. both ends of every row until 93 st. remain. Cont. without shaping until the work measures 24in. from cast-on edge, ending with a row on the wrong side.

Shaping the neck and shoulders: Next row: K. 35, turn and work on these 35 st. only for one side of the neck thus: First row: Work 2 tog., work to the end. Second row: Cast off 10, work to the last 2 st., work 2 tog. Rep. these 2 rows once more, then first row once again. Cast off remaining 10 st. Return to the remaining stitches and with the right side of the work facing begin at the neck edge and slip the first 23 st. on a spare needle. Rejoin the wool and work on the remaining 35 st. to match the first side of the neck.

The Front

Work as given for the back until the work measures 15in. from cast-on edge, ending with a p. row. Change to c. and work 2 rows st. st. Now work the design from the accompanying chart. The motif covers the centre 49 st. in each row for 56 rows. Each square on the chart represents 1 st. and each line of squares represents 1 row; the crosses are the stitches worked in main colour, and the plain squares are the stitches worked in contrasting colour.



When working with the 2-colour wools do not weave the wools at the back of the work, but strand across, and where more than 6 st. are worked in one colour catch up the contrasting colour once or twice on the wrong side. Where the colours change at the same place in 2 or more rows twist the wools at the back of the work to prevent a hole. The odd-numbered rows are k. rows and are worked from right to left, and the even-numbered rows are p. rows and are worked from left to right

Thus the first 2 rows will be:—

First row: With mn. k. 34, now working from the chart k. 20 mn., 9 c., 20 mn. With mn., k. to the end. Second row: With mn. p. 34, now working from the chart p. 15 mn., 5 c., 9 mn., 5 c., 15 mn. With mn., p. to end.

Cont. working through the chart until the work measures 16in. from cast-on edge.

Shaping the armholes: Keeping the continuity of the design on the centre 49 st., cast off 4 st. at beg. of next 2 rows, then dec. 1 st. both ends of every row until 93 st. remain. Then cont. without shaping until the 56 rows of the chart have been completed. Break off c. wool and cont. in st. st. with mn. wool until the work measures 21½in. from cast-on edge, ending with a p. row.

Shaping the neck: Next row: K. 40, turn and work on these stitches only for one side of the neck, leaving the remaining stitches on a spare needle. Cont. in st. st. on these 40 st., dec. 1 st. at the neck edge in every row until 30 st. remain. Then cont. without shaping until work measures 24in. from cast-on edge, ending at armhole edge.

Shaping the shoulder: Next row: Cast off 10, work to the end. Next row: Work to the end. Rep. these 2 rows once more. Cast off the remaining stitches. Return to stitches on the spare needle, with the right side of the work facing, and beg. at the neck edge slip the first 13 st. on a spare needle. Rejoin the wool and work on the remaining 40 st. to match the first side of the neck.

The Sleeves

With No. 12 needles and mn. wool cast on 56 st. and work in rib as given for lower edge of the back for 2in., ending with a second row of rib. Change to No. 9 needles and cont. in st. st., inc. 1 st. both ends of seventh and every following eighth row until there are 88 st. Cont. without shaping until work is 18in. from cast-on edge.

Shaping the top: Dec. 1 st. both ends of every alternate row until 56 st. remain. Now dec. 1 st. both ends of every row until 40 st. remain. Cast off 5 st. at beg. of next 6 rows. Cast off the remaining stitches.

The Collar

Join shoulder seams. With right side of work facing and using the four No. 9 needles and mn. wool begin at left shoulder seam and pick up and k. 24 st. evenly down neck edge of the front, k. across the 13 st. from the spare needle, pick up and k. 24 st. along other edge of the front, then pick up and k. 8 st. down neck edge of the back, k. across the 23 st. from the spare needle, pick up and k. 8 st. along other edge of the back.

Arrange these 100 st. evenly on three needles and work in rounds, beg. each round at left shoulder seam thus: First round: * K. 1, p. 4. Rep. from * to end. Rep. this round until collar measures 1in. Change to No. 12 needles and cont. in rib until collar is 2in. Cast off loosely in rib.

Press work lightly with hot iron and damp cloth. Join side and sleeve seams and sew in sleeves with seams to side seams. Press seams.

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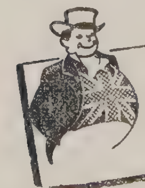

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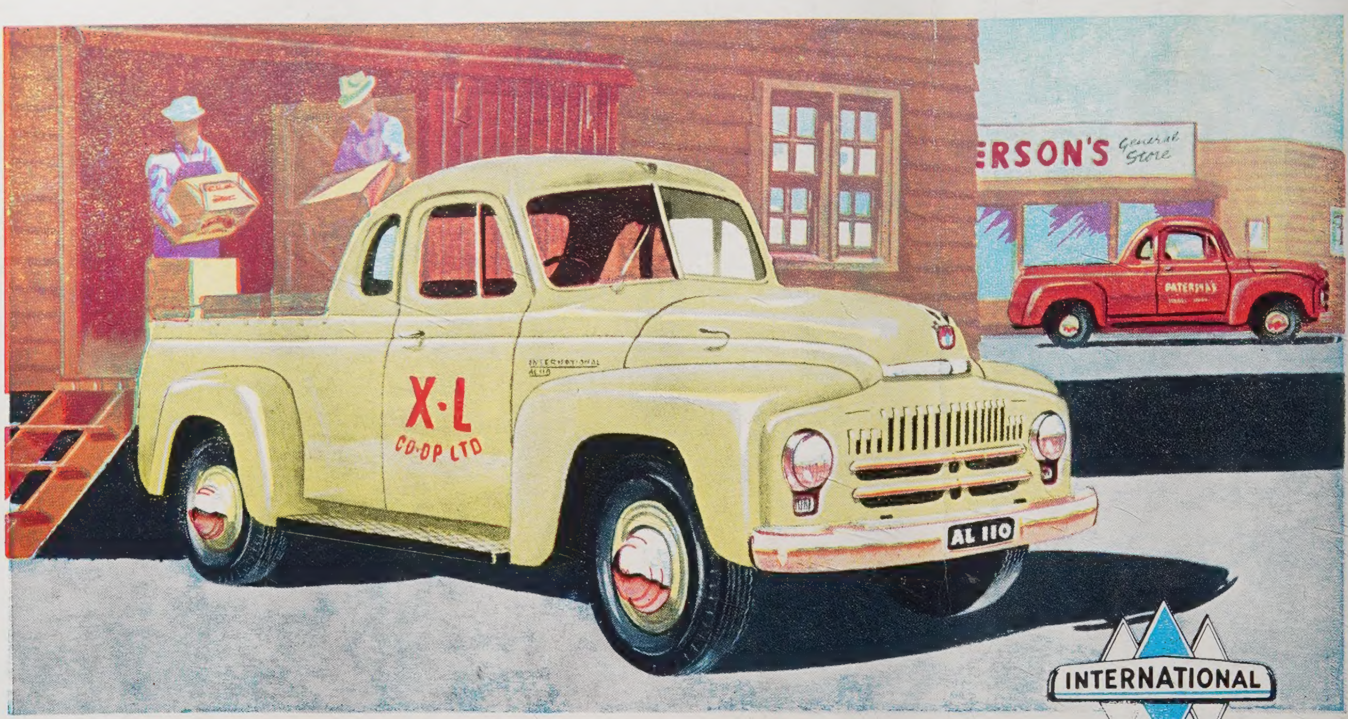

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